

*AIRS*  
Atmospheric Infrared Sounder

# AIRS Version 3.0 Released Files Description



June 2003  
Version 1.0



Jet Propulsion Laboratory  
California Institute of Technology  
Pasadena, California

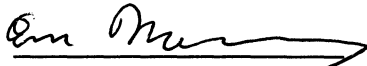
JPL D-26381

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Atmospheric Infrared Sounder

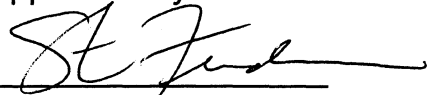
# AIRS Version 3.0 Released Files Description

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## Document Change Log

Date	Version Number	Reason for Change
June 2003	Initial Release	

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# 1 Introduction

## 1.1 Purpose

This document describes the released product files for the Version 3.0.4.0 (V3.0.4.0) delivery of the AIRS Science Processing System (ASPS). These products incorporate data from the AIRS, AMSU-A (AMSU-A1 + AMSU-A2) and HSB instruments.

The sample data includes Level 1B calibrated radiances and Level 2 retrievals.

The basic product file types and two QA subset file types are shown in Table 1.

**Table 1. Product File Types**

<i>ESDT Shortname</i>	<i>Mnemonic Name</i>
AIRIBRAD	L1B_AIRS_SCIENCE
AIRIBQAP	L1B_AIRS_QA
AIRVBRAD	L1B_VIS_SCIENCE
AIRVBQAP	L1B_VIS_QA
AIRABRAD	L1B_AMSU_SCIENCE
AIRHBRAD	L1B_HSB_SCIENCE
AIRX2RET	L2_Standard_atmospheric&surface_product
AIRI2CCF	L2_Standard_cloud-cleared_radiance_product
AIRX2SUP	L2_Support_atmospheric&surface_product

Each L1B science file type contains calibrated radiances from 6 minutes of observations. The corresponding QA subset files exclude radiances and other large fields to deliver QA in a compact format.

Data from the AIRS instrument is divided into separate products: AIRIBRAD has infrared data, while AIRVBRAD has Vis/NIR data.

AIRS IR and Vis/NIR radiances are in radiance units, while MW instrument data AIRABRAD and AIRHBRAD are in brightness temperature units.

In Level 2 atmospheric and surface quantities are estimated from the Level 1B data.

## 1.2 Applicable Documents

AIRS Version 3.0 Processing Files Description, JPL D-26382, June 2003

Interface Control Document between the Earth Science Data and Information System (ESDIS) and the AIRS Science Processing Systems (ASPS), Earth Science Data and Information System Project Number 423-42-07, JPL D-22992, February 2002

Operations Agreement (OA) between the Goddard Space Flight Center (GSFC) Distributed Active Archive Center (DAAC) and the AIRS Team Leader Science Computing Facility (TLSCF), JPL D-23045, January 2002

AIRS Science Processing System Software Development Methodology, JPL D-18573, February 19, 2000

AIRS Product Generation System (PGS) Version 2.1 Requirements and Design Document, JPL D-19556, January 2001

AIRS Product Generation System (PGS) Version 1.5 Requirements and Design Document, JPL D-18926, January 2001

AIRS Product Generation System (PGS) Version 1 Requirements and Design Document (Preliminary), JPL D-17851, Version 1.1, July 1999

AIRS Version 2.0 System Description Document, Version 2.0, JPL D-19557, August 2000

AIRS Science Software Integration and Test Procedures and Agreement with the Goddard Space Flight Center Distributed Active Archive Center, JPL D-16791, Version 3, Revision 2.0, June 1, 2000

AIRS Product Generation System (PGS) Prototype 8 Requirements and Design Document (Preliminary), JPL D-16451, Version 1.0, December 1998

AIRS Data Processing and Instrument Operations (DPIO) Software Requirements Document, JPL D-16785, Version 1.0, April 3, 1998

### **1.3 Acronyms**

AIRS	Atmospheric Infrared Sounder
AMSU-A	Advanced Microwave Sounding Unit - Version A (AMSU-A1 and AMSU-A2)
APID	Application Process Identifier
ASPS	AIRS Science Processing System
BRTEMP	Brightness Temperature
DAAC	Distributed Active Archive Center
DECOM	Decommuration
DN	Data Number
DPIO	Data Processing and Instrument Operations
ECS	EOSDIS Core System
EDOS	EOS Data Operations Service
EMOS	EOS Mission Operations System
ENG	Engineering
EOS	Earth Observing System
ESDIS	Earth Science and Data Information System
ESDT	Earth Science Data Type
GSFC	Goddard Space Flight Center

HSB	Humidity Sounder for Brazil
HDF	Hierarchical Data Format
ICD	Interface Control Document
IR	Infrared
L1A	Level 1A
L1B	Level 1B
L2	Level 2
LGID	Local Granule ID
LID	Logical ID
MW	Microwave
NDVI	Normalized Differential Vegetation Index
NIR	Near Infrared
NOAA	National Oceanic and Atmospheric Administration
OA	Operations Agreement
PCF	Process Control File
PGE	Product Generation Executive
PGS	Product Generation System
PSA	Product Specific Attributes
QA	Quality Assessment
SCF	Science Computing Facility
SDPS	Science and Data Processing Segment
SPS	Science Processing System
SSI&T	Science Software Integration and Test
TAI	Universal Atomic Time
TLSCF	Team Leader Science Computing Facility
Vis	Visible
UTC	Coordinated Universal Time

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# Appendix A. Product Interface Specifications

## A-1. L1B AIRS Science Interface Specification

Interface Specification Version 3.0.4.0  
2003-05-19

ESDT ShortName = "AIRIBRAD"

Swath Name = "L1B\_AIRS\_Science"

Level = "level1B"

# Footprints = 90

# scanlines per scanset = 3

### Dimensions

These fields define all dimensions that can be used for HDF-EOS swath fields.

The names "GeoTrack" and "GeoXTrack" have a special meaning for this document: "Cross-Track" data fields have a hidden dimension of "GeoXTrack"; "Along-Track" data fields have a hidden dimension of "GeoTrack"; "Full Swath Data Fields have hidden dimensions of both "GeoTrack" and "GeoXTrack".

Name	Value	Explanation
GeoXTrack	90	Dimension across track for footprint positions. Same as number of footprints per scanline. -- starting at the left and increasing towards the right as you look along the satellite's path
GeoTrack	# of scan lines in swath	Dimension along track for footprint positions. Same as number of scanlines in granule. Parallel to the satellite's path, increasing with time. (Nominally 45 for Level-2, AMSU-A, and AIRS/Vis low-rate engineering; 135 for AIRS/Vis and HSB high-rate quantities)
CalXTrack	6	Dimension "across" track for calibration footprint positions. Same as number of calibration footprints per scanline. (NUM_FOOTPRINTS_AIRS_CALIB) (Footprints are ordered: 1-4: spaceviews (ports 3, 4, 1, 2); 5: blackbody radiometric calibration source; 6: spectral/photometric calibration sources)
SpaceXTrack	4	Dimension "across" track for spaceview calibration footprint positions in order of observation time. (NUM_FOOTPRINTS_AIRS_SPACE)
BBXTrack	1	Dimension "across" track for blackbody calibration footprint positions in order of observation time. (NUM_FOOTPRINTS_AIRS_BB)
Channel	2378	Dimension of channel array (Channels are generally in order of increasing wavenumber, but because frequencies can vary and because all detectors from a physical array of detector elements (a "module") are always grouped together there are sometimes small reversals in frequency order where modules overlap.)
MaxRefChannel	100	Maximum number of radiometric reference channels. "RefChannels" lists the channels used.
MaxFeaturesUpwell	35	Maximum number of spectral features in upwelling radiances used for spectral calibration
MaxFeaturesPary	17	Maximum number of spectral features in parylene radiances used for spectral calibration

### Geolocation Fields

These fields appear for every footprint (GeoTrack \* GeoXTrack times) and correspond to footprint center coordinates and "shutter" time.

Name	Explanation
Latitude	Footprint boresight geodetic Latitude in degrees North (-90.0 ... 90.0)
Longitude	Footprint boresight geodetic Longitude in degrees East (-180.0 ... 180.0)
Time	Footprint "shutter" TAI Time: floating-point elapsed seconds since Jan 1, 1993

Size: 291600 bytes (0.3 MB) per 45-scanset granule

### Attributes

These fields appear only once per granule

Name	Type	Extra Dimensions	Explanation
processing_level	string of 8-bit characters	None	Zero-terminated character string denoting processing level ("level1B")
instrument	string of 8-bit characters	None	Zero-terminated character string denoting instrument ("AIRS")
DayNightFlag	string of 8-bit characters	None	Zero-terminated character string denoting granule as day and/or night: (Always "Day", "Night", or "Both")
AutomaticQAFlag	string of 8-bit characters	None	Zero-terminated character string denoting granule data quality: (Always "Passed", "Failed", or "Suspect")

NumTotalData	32-bit integer	None	Total number of expected scene footprints
NumProcessData	32-bit integer	None	Number of scene footprints which are present and can be processed routinely (state = 0)
NumSpecialData	32-bit integer	None	Number of scene footprints which are present and can be processed only as a special test (state = 1)
NumBadData	32-bit integer	None	Number of scene footprints which are present but cannot be processed (state = 2)
NumMissingData	32-bit integer	None	Number of expected scene footprints which are not present (state = 3)
NumLandSurface	32-bit integer	None	Number of scene footprints for which the surface is more than 90% land
NumOceanSurface	32-bit integer	None	Number of scene footprints for which the surface is less than 10% land
node_type	string of 8-bit characters	None	Zero-terminated character string denoting whether granule is ascending, descending, or pole-crossing: ("Ascending" and "Descending" for entirely ascending or entirely descending granules, or "NorthPole" or "SouthPole" for pole-crossing granules)
start_year	32-bit integer	None	Year in which granule started, UTC (e.g. 1999)
start_month	32-bit integer	None	Month in which granule started, UTC (1 ... 12)
start_day	32-bit integer	None	Day of month in which granule started, UTC (1 ... 31)
start_hour	32-bit integer	None	Hour of day in which granule started, UTC (0 ... 23)
start_minute	32-bit integer	None	Minute of hour in which granule started, UTC (0 ... 59)
start_sec	32-bit floating-point	None	Second of minute in which granule started, UTC (0.0 ... 59.0)
start_orbit	32-bit integer	None	Orbit number of mission in which granule started
end_orbit	32-bit integer	None	Orbit number of mission in which granule ended
orbit_path	32-bit integer	None	Orbit path of start orbit (1 ... 233 as defined by EOS project)
start_orbit_row	32-bit integer	None	Orbit row at start of granule (1 ... 248 as defined by EOS project)
end_orbit_row	32-bit integer	None	Orbit row at end of granule (1 ... 248 as defined by EOS project)
granule_number	32-bit integer	None	Number of granule within day (1 ... 240)
num_scansets	32-bit integer	None	Number of scansets in granule (1 ... 45)
num_scanlines	32-bit integer	None	Number of scanlines in granule (3 * num_scansets)
start_Latitude	64-bit floating-point	None	Geodetic Latitude of spacecraft at start of granule in degrees North (-90.0 ... 90.0)
start_Longitude	64-bit floating-point	None	Geodetic Longitude of spacecraft at start of granule in degrees East (-180.0 ... 180.0)
start_Time	64-bit floating-point	None	TAI Time at start of granule (floating-point elapsed seconds since start of 1993)
end_Latitude	64-bit floating-point	None	Geodetic Latitude of spacecraft at end of granule in degrees North (-90.0 ... 90.0)
end_Longitude	64-bit floating-point	None	Geodetic Longitude of spacecraft at end of granule in degrees East (-180.0 ... 180.0)
end_Time	64-bit floating-point	None	TAI Time at end of granule (floating-point elapsed seconds since start of 1993)
eq_x_longitude	32-bit floating-point	None	Longitude of spacecraft at southward equator crossing nearest granule start in degrees East (-180.0 ... 180.0)
eq_x_tai	64-bit floating-point	None	Time of eq_x_longitude in TAI units (floating-point elapsed seconds since start of 1993)
orbitgeoqa	32-bit unsigned integer	None	Orbit Geolocation QA: bit 0 (LSB): bad input value (last scanline); bit 1: bad input value (first scanline); bit 2: PGS_EPH_GetEphMet() returned PGSEPH_E_NO_SC_EPHEM_FILE; bit 3: PGS_EPH_GetEphMet() returned PGSEPH_E_BAD_ARRAY_SIZE; bit 4: PGS_EPH_GetEphMet() returned PGSTD_E_TIME_FMT_ERROR; bit 5: PGS_EPH_GetEphMet() returned PGSTD_E_TIME_VALUE_ERROR; bit 6: PGS_EPH_GetEphMet() returned PGSTD_E_SC_TAG_UNKNOWN; bit 7: PGS_EPH_GetEphMet() returned PGS_E_TOOLKIT; bit 8: PGS_TD_UTCToTAI() returned PGSTD_E_NO_LEAP_SECS; bit 9: PGS_TD_UTCToTAI() returned PGSTD_E_TIME_FMT_ERROR; bit 10: PGS_TD_UTCToTAI() returned PGSTD_E_TIME_VALUE_ERROR; bit 11: PGS_TD_UTCToTAI() returned PGS_E_TOOLKIT; bit 12: PGS_CSC_DayNight() returned PGSTD_E_NO_LEAP_SECS; bit 13: PGS_CSC_DayNight() returned PGSCSC_E_INVALID_LIMITTAG; bit 14: PGS_CSC_DayNight() returned PGSCSC_E_BAD_ARRAY_SIZE; bit 15: PGS_CSC_DayNight() returned PGSCSC_W_ERROR_IN_DAYNIGHT; bit 16: PGS_CSC_DayNight() returned PGSCSC_W_BAD_TRANSFORM_VALUE; bit 17: PGS_CSC_DayNight() returned PGSCSC_W_BELOW_HORIZON; bit 18: PGS_CSC_DayNight() returned PGSCSC_W_PREDICTED_UT1; bit 19: PGS_CSC_DayNight() returned PGSTD_E_NO_UT1_VALID; bit 20:

			PGS_CSC_DayNight() returned PGSTD_E_BAD_INITIAL_TIME; bit 21: PGS_CSC_DayNight() returned PGSCBP_E_TIME_OUT_OF_RANGE; bit 22: PGS_CSC_DayNight() returned PGSCBP_E_UNABLE_TO_OPEN_FILE; bit 22: PGS_CSC_DayNight() returned PGSMEM_E_NO_MEMORY; bit 24: PGS_CSC_DayNight() returned PGS_E_TOOLKIT; bit 25-31: not used
num_satgeoqa	16-bit integer	None	Number of scans with problems in satgeoqa
num_glintgeoqa	16-bit integer	None	Number of scans with problems in glintgeoqa
num_moongoqa	16-bit integer	None	Number of scans with problems in moongoqa
num_ftptgeoqa	16-bit integer	None	Number of footprints with problems in ftptgeoqa
num_zengeoqa	16-bit integer	None	Number of footprints with problems in zengeoqa
num_demgeoqa	16-bit integer	None	Number of footprints with problems in demgeoqa
num_fpe	16-bit integer	None	Number of floating point errors
LonGranuleCen	16-bit integer	None	Geodetic Longitude of the center of the granule in degrees East (-180 ... 180)
LatGranuleCen	16-bit integer	None	Geodetic Latitude of the center of the granule in degrees North (-90 ... 90)
LocTimeGranuleCen	16-bit integer	None	Local solar time at the center of the granule in minutes past midnight (0 ... 1439)
CalGranSummary	8-bit unsigned integer	None	Bit field. Bitwise OR of CalChanSummary, over all good channels (see ExcludedChans) Zero means all good channels were well calibrated, for all scanlines. bit 7 (MSB): scene over/underflow; bit 6: anomaly in offset calculation; bit 5: anomaly in gain calculation; bit 4: pop detected; bit 3: noise out of bounds; bit 2: anomaly in spectral calibration; bit 1: Telemetry; bit 0: unused (reserved);
CalChanSummary	8-bit unsigned integer	Channel (= 2378)	Bit field. Bitwise OR of CalFlag, by channel, over all scanlines. Noise threshold and spectral quality added. Zero means the channel was well calibrated for all scanlines bit 7 (MSB): scene over/underflow; bit 6: anomaly in offset calculation; bit 5: anomaly in gain calculation; bit 4: pop detected; bit 3: noise out of bounds; bit 2: anomaly in spectral calibration; bit 1: Telemetry; bit 0: unused (reserved);
ExcludedChans	8-bit unsigned integer	Channel (= 2378)	An integer 0-6, indicating A/B detector weights. Used in L1B processing. 0 - A weight = B weight. Probably better that channels with state > 2; 1 - A-side only. Probably better that channels with state > 2; 2 - B-side only. Probably better that channels with state > 2; 3 - A weight = B weight. Probably better than channels with state = 6; 4 - A-side only. Probably better than channels with state = 6; 5 - B-side only. Probably better than channels with state = 6; 6 - A weight = B weight.
NeN	32-bit floating-point	Channel (= 2378)	Noise-equivalent Radiance (radiance units) for an assumed 250K scene
DCR_scan	16-bit integer	None	Scanline number of (first) DC-Restore. 0 for no DC-Restore
input_scene_counts	Limited Engineering Struct (see below)	Channel (= 2378)	Input statistics on scene data numbers
input_space_counts	Limited Engineering Struct (see below)	SpaceXTrack (= 4) * Channel (= 2378)	Input statistics on spaceview data numbers
input_space_signals	Limited Engineering Struct (see below)	SpaceXTrack (= 4) * Channel (= 2378)	Input statistics on spaceview signals (data numbers with offset subtracted)
input_space_diffs	Unlimited Engineering Struct (see below)	SpaceXTrack (= 4) * Channel (= 2378)	Statistics on differences between corresponding space views, for consecutive scanlines
input_bb_counts	Limited Engineering Struct (see below)	Channel (= 2378)	Input statistics on blackbody calibration data numbers
input_bb_signals	Limited Engineering Struct (see below)	Channel (= 2378)	Input statistics on blackbody calibration signals (data numbers with offset subtracted)
input_spec_counts	Limited Engineering Struct (see below)	Channel (= 2378)	Input statistics on spectral calibration data numbers
input_bb_temp	Limited Engineering Struct (see below)	None	Input statistics on Blackbody temperature

	below)		
input_bb_temp1	Limited Engineering Struct (see below)	None	Input statistics on Blackbody temperature 1A (CaBbTempV1A or CaBbTempV1B, as active)
input_bb_temp2	Limited Engineering Struct (see below)	None	Input statistics on Blackbody temperature 2 (CaBbTempV2A or CaBbTempV2B, as active)
input_bb_temp3	Limited Engineering Struct (see below)	None	Input statistics on Blackbody temperature 3 (CaBbTemp3, active A or B)
input_bb_temp4	Limited Engineering Struct (see below)	None	Input statistics on Blackbody temperature4 (CaBbTemp4, active A or B)
input_spec_temp	Limited Engineering Struct (see below)	None	Input statistics on Spectrometer temperature
input_ir_det_temp	Limited Engineering Struct (see below)	None	Input statistics on IR detector temperature
input_grating_temp_1	Limited Engineering Struct (see below)	None	Input statistics on Grating temperature 1 (SpGratngTemp1, active A or B)
input_grating_temp_2	Limited Engineering Struct (see below)	None	Input statistics on Grating temperature 2 (SpGratngTemp2, active A or B)
input_entr_filt_temp	Limited Engineering Struct (see below)	None	Input statistics on the entrance filter temperature (SpEntFiltTmp, active A or B)
input_opt_bench_temp_2	Limited Engineering Struct (see below)	None	Input statistics on optical bench temperature 2 (SpOptBnchTmp2, active A or B)
input_opt_bench_temp_3	Limited Engineering Struct (see below)	None	Input statistics on optical bench temperature 3 (SpOptBnchTmp3, active A or B)
input_scan_mirror_temp	Limited Engineering Struct (see below)	None	Input statistics on scan mirror housing temperature
input_chopper_phase_err	Limited Engineering Struct (see below)	None	Input statistics on chopper phase error voltage (ChPhaseErrVA or ChPhaseErrVB, as active)
PopCount	32-bit integer	None	Number of popcorn events within granule, i.e. number of times than an AIRS channel used in the Level 2 retrieval has suffered a sudden discontinuity in dark current
offset_stats	Unlimited Engineering Struct (see below)	Channel (= 2378)	Statistics on offsets
gain_stats	Unlimited Engineering Struct (see below)	Channel (= 2378)	Statistics on gains
rad_stats	Unlimited Engineering Struct (see below)	Channel (= 2378)	Statistics on radiances (radiance units)
NumRefChannels	32-bit integer	None	The number of channels reported in MaxRefChannel arrays
RefChannels	32-bit integer	MaxRefChannel (= 100)	The 1-based indexes of channels reported in MaxRefChannel arrays
rad_scan_stats	Unlimited Engineering Struct (see below)	GeoXTrack (= 90) * MaxRefChannel (= 100)	Statistics on scan angle dependence of radiances



	below)		
Rdiff_swindow_M1a_chan	16-bit integer	None	Array M1a channel used as one reference in calculating Rdiff_swindow. (index into radiance & frequency arrays 1...2378)
Rdiff_swindow_M2a_chan	16-bit integer	None	Array M2a channel used as one reference in calculating Rdiff_swindow. (index into radiance & frequency arrays 1...2378)
Rdiff_lwindow_M8_chan	16-bit integer	None	Array M8 channel used as one reference in calculating Rdiff_lwindow. (index into radiance & frequency arrays 1...2378)
Rdiff_lwindow_M9_chan	16-bit integer	None	Array M9 channel used as one reference in calculating Rdiff_lwindow. (index into radiance & frequency arrays 1...2378)
Rdiff_strat_M2b_chan	16-bit integer	None	Array M2b channel used as one reference in calculating Rdiff_strat. (index into radiance & frequency arrays 1...2378)
Rdiff_strat_M1b_chan	16-bit integer	None	Array M1b channel used as one reference in calculating Rdiff_strat. (index into radiance & frequency arrays 1...2378)
granules_present	string of 8-bit characters	None	Zero-terminated character string denoting which adjacent granules were available for smoothing ("All" for both previous & next, "Prev" for previous but not next, "Next" for next but not previous, "None" for neither previous nor next)
spectral_TAI	64-bit floating-point	None	TAI time of (first) Spectral calibration. (floating-point elapsed seconds since start of 1993) 0 for no Spectral calibration occurred in this granule.
nominal_freq	32-bit floating-point	Channel (= 2378)	Nominal frequencies (in cm <sup>-1</sup> ) of each channel
spectral_freq	32-bit floating-point	Channel (= 2378)	Calculated frequencies (in cm <sup>-1</sup> )
spectral_freq_unc	32-bit floating-point	Channel (= 2378)	Uncertainty in calculated frequencies (in cm <sup>-1</sup> )
spec_shift_upwell	32-bit floating-point	None	Focal plane shift calculated in grating model fit to upwelling radiances (microns)
spec_shift_unc_upwell	32-bit floating-point	None	Uncertainty of the focal plane shift calculated in the grating model fit to upwelling radiances (microns)
spec_fl_upwell	32-bit floating-point	None	Focal length calculated in grating model fit to upwelling radiances (microns)
spec_fl_unc_upwell	32-bit floating-point	None	Uncertainty of focal length calculated in grating model fit to upwelling radiances (microns)
SpectralFeaturesUpwell	32-bit integer	None	The actual number of upwelling features for MaxFeaturesUpwell-sized arrays
spec_feature_shifts_upwell	32-bit floating-point	MaxFeaturesUpwell (= 35)	Spectral shift seen for each upwelling feature, in microns at the focal plane
spec_feature_corr_upwell	32-bit floating-point	MaxFeaturesUpwell (= 35)	Maximum correlation seen for each upwelling feature (0.0 ... 1.0)
spec_feature_sharp_upwell	32-bit floating-point	MaxFeaturesUpwell (= 35)	Quadratic coefficient in fit to correlation for each upwelling feature
spec_feature_resid_upwell	32-bit floating-point	MaxFeaturesUpwell (= 35)	Fit residual for each upwelling feature (wavenumbers)
spec_iter_upwell	16-bit integer	None	Number of amoeba iterations to fit the grating model to upwelling radiance feature positions
spec_feature_contrast_stats	Limited Engineering Struct (see below)	MaxFeaturesUpwell (= 35)	Statistics on the spectral contrasts for each of the upwelling features, for each of the scene footprints considered for spectral calibration
spec_clim_select	16-bit integer	None	Number of the climatology to which the upwelling features were fitted
spec_shift_pary	32-bit floating-point	None	Focal plane shift calculated in grating model fit to parylene radiances (microns)
spec_shift_unc_pary	32-bit floating-point	None	Uncertainty of the focal plane shift calculated in grating model fit to parylene radiances (microns)
spec_fl_pary	32-bit floating-point	None	Focal length calculated in grating model fit to parylene radiances (microns)
spec_fl_unc_pary	32-bit floating-point	None	Uncertainty of focal length calculated in grating model fit to parylene radiances (microns)
SpectralFeaturesPary	32-bit integer	None	The actual number of parylene features for MaxFeaturesPary-sized arrays
spec_feature_shifts_pary	32-bit floating-point	MaxFeaturesPary (= 17)	Spectral shift seen for each parylene feature, in microns at the focal plane
spec_feature_corr_pary	32-bit floating-point	MaxFeaturesPary (= 17)	Maximum correlation seen for each parylene feature (0.0 ... 1.0)
spec_feature_sharp_pary	32-bit floating-point	MaxFeaturesPary (= 17)	Quadratic coefficient in fit to correlation for each parylene feature

	point	17)	
spec_feature_resid_pary	32-bit floating-point	MaxFeaturesPary (= 17)	Fit residual for each parylene feature (wavenumbers)
spec_iter_pary	16-bit integer	None	Number of amoeba iterations in fit the grating model to parylene radiance feature positions
ave_pary_spectrum	32-bit floating-point	Channel (= 2378)	The average parylene spectrum (over good scanlines), in milliWatts/m**2/cm**-1/steradian
DCRCOUNT	32-bit integer	None	Number of times a Direct Current Restore was executed for any module

Size: 3776779 bytes (3.8 MB) per granule

## Along-Track Data Fields

These fields appear once per scanline (GeoTrack times)

Name	Type	Extra Dimensions	Explanation
satheight	32-bit floating-point	None	Satellite altitude at nadirTAI in km above reference ellipsoid (e.g. 725.2)
satroll	32-bit floating-point	None	Satellite attitude roll angle at nadirTAI (-180.0 ... 180.0 angle about the +x (roll) ORB axis, +x axis is positively oriented in the direction of orbital flight completing an orthogonal triad with y and z.)
satpitch	32-bit floating-point	None	Satellite attitude pitch angle at nadirTAI (-180.0 ... 180.0 angle about +y (pitch) ORB axis, +y axis is oriented normal to the orbit plane with the positive sense opposite to that of the orbit's angular momentum vector H.)
satyaw	32-bit floating-point	None	Satellite attitude yaw angle at nadirTAI (-180.0 ... 180.0 angle about +z (yaw) axis, +z axis is positively oriented earthward parallel to the satellite radius vector R from the spacecraft center of mass to the center of the Earth.)
satgeoqa	32-bit unsigned integer	None	Satellite Geolocation QA flags: bit 0 (LSB): bad input value; bit 1: PGS_TD_TAItoUTC() returned PGSTD_E_NO_LEAP_SECS; bit 2: PGS_TD_TAItoUTC() returned PGS_E_TOOLKIT; bit 3: PGS_EPH_EphemAttit() returned PGSEPH_W_BAD_EPHEM_VALUE; bit 4: PGS_EPH_EphemAttit() returned PGSEPH_E_BAD_EPHEM_FILE_HDR; bit 5: PGS_EPH_EphemAttit() returned PGSEPH_E_NO_SC_EPHEM_FILE; bit 6: PGS_EPH_EphemAttit() returned PGSEPH_E_NO_DATA_REQUESTED; bit 7: PGS_EPH_EphemAttit() returned PGSTD_E_SC_TAG_UNKNOWN; bit 8: PGS_EPH_EphemAttit() returned PGSEPH_E_BAD_ARRAY_SIZE; bit 9: PGS_EPH_EphemAttit() returned PGSTD_E_TIME_FMT_ERROR; bit 10: PGS_EPH_EphemAttit() returned PGSTD_E_TIME_VALUE_ERROR; bit 11: PGS_EPH_EphemAttit() returned PGSTD_E_NO_LEAP_SECS; bit 12: PGS_EPH_EphemAttit() returned PGS_E_TOOLKIT; bit 13: PGS_CSC_ECIttoECR() returned PGSCSC_W_BAD_TRANSFORM_VALUE; bit 14: PGS_CSC_ECIttoECR() returned PGSCSC_E_BAD_ARRAY_SIZE; bit 15: PGS_CSC_ECIttoECR() returned PGSTD_E_NO_LEAP_SECS; bit 16: PGS_CSC_ECIttoECR() returned PGSTD_E_TIME_FMT_ERROR; bit 17: PGS_CSC_ECIttoECR() returned PGSTD_E_TIME_VALUE_ERROR; bit 18: unused (set to zero); bit 19: PGS_CSC_ECIttoECR() returned PGSTD_E_NO_UT1_VALUE; bit 20: PGS_CSC_ECIttoECR() returned PGS_E_TOOLKIT; bit 21: PGS_CSC_ECRtoGEO() returned PGSCSC_W_TOO_MANY_ITERS; bit 22: PGS_CSC_ECRtoGEO() returned PGSCSC_W_INVALID_ALTITUDE; bit 23: PGS_CSC_ECRtoGEO() returned PGSCSC_W_SPHERE_BODY; bit 24: PGS_CSC_ECRtoGEO() returned PGSCSC_W_LARGE_FLATTENING; bit 25: PGS_CSC_ECRtoGEO() returned PGSCSC_W_DEFAULT_EARTH_MODEL; bit 26: PGS_CSC_ECRtoGEO() returned PGSCSC_E_BAD_EARTH_MODEL; bit 27: PGS_CSC_ECRtoGEO() returned PGS_E_TOOLKIT; bit 28-31: not used
glintgeoqa	16-bit unsigned integer	None	Glint Geolocation QA flags: bit 0 (LSB): bad input value; bit 1: glint location in Earth's shadow; bit 2: glint calculation not converging; bit 3: glint location sun vs. satellite zenith mismatch; bit 4: glint location sun vs. satellite azimuth mismatch; bit 5: bad glint location; bit 6: PGS_CSC_ZenithAzimuth() returned any 'W' class return code; bit 7: PGS_CSC_ZenithAzimuth() returned any 'E' class return code; bit 8: PGS_CBP_Earth_CB_Vector() returned returned any 'W' class return code; bit 9: PGS_CBP_Earth_CB_Vector() returned returned any 'E' class return code; bit 10: PGS_CSC_ECIttoECR() returned any 'W' class return code except PGSCSC_W_PREDICTED_UT1 (for Glint); bit 11: PGS_CSC_ECIttoECR() returned any 'E' class return code (for Glint); bit 12: PGS_CSC_ECRtoGEO() returned any 'W' class return code (for Glint); bit 13: PGS_CSC_ECRtoGEO() returned any 'E' class return code (for Glint); bit 14: PGS_CSC_ECIttoECR() returned any 'W' class return code except PGSCSC_W_PREDICTED_UT1; bit 15: PGS_CSC_ECIttoECR() returned any 'E' class return code
moongeoa	16-bit unsigned integer	None	Moon Geolocation QA flags: bit 0 (LSB): bad input value; bit 1: PGS_TD_TAItoUTC() returned PGSTD_E_NO_LEAP_SECS; bit 2: PGS_TD_TAItoUTC() returned PGS_E_TOOLKIT; bit 3: PGS_CBP_Sat_CB_Vector() returned PGSCSC_W_BELOW_SURFACE; bit 4: PGS_CBP_Sat_CB_Vector() returned PGSCBP_W_BAD_CB_VECTOR; bit 5: PGS_CBP_Sat_CB_Vector() returned PGSCBP_E_BAD_ARRAY_SIZE; bit 6: PGS_CBP_Sat_CB_Vector() returned PGSCBP_E_INVALID_CB_ID; bit 7: PGS_CBP_Sat_CB_Vector() returned PGSMEM_E_NO_MEMORY; bit 8: PGS_CBP_Sat_CB_Vector() returned PGSCBP_E_UNABLE_TO_OPEN_FILE; bit 9: PGS_CBP_Sat_CB_Vector() returned PGSTD_E_BAD_INITIAL_TIME; bit 10: PGS_CBP_Sat_CB_Vector() returned PGSCBP_E_TIME_OUT_OF_RANGE; bit 11: PGS_CBP_Sat_CB_Vector() returned PGSTD_F_SC_TAG_UNKNOWN; bit 12: PGS_CBP_Sat_CB_Vector() returned

			PGSEPH_E_BAD_EPHEM_FILE_HDR; bit 13: PGS_CBP_Sat_CB_Vector() returned PGSEPH_E_NO_SC_EPHEM_FILE; bit 14: PGS_CBP_Sat_CB_Vector() returned PGS_E_TOOLKIT; bit 15: not used
nadirTAI	64-bit floating-point	None	TAI time at which instrument is nominally looking directly down. (between footprints 15 & 16 for AMSU or between footprints 45 & 46 for AIRS/Vis & HSB) (floating-point elapsed seconds since start of 1993)
sat_lat	64-bit floating-point	None	Satellite geodetic latitude in degrees North (-90.0 ... 90.0)
sat_lon	64-bit floating-point	None	Satellite geodetic longitude in degrees East (-180.0 ... 180.0)
scan_node_type	8-bit integer	None	'A' for ascending, 'D' for descending, 'N' for North-Polar, 'S' for South-Polar
glintlat	32-bit floating-point	None	Solar glint geodetic latitude in degrees North at nadirTAI (-90.0 ... 90.0)
glintlon	32-bit floating-point	None	Solar glint geodetic longitude in degrees East at nadirTAI (-180.0 ... 180.0)
CalScanSummary	8-bit unsigned integer	None	Bit field. Bitwise OR of CalFlag over the good channel list (see ExcludedChans). Zero means all "good" channels were well calibrated for this scanline bit 7 (MSB): scene over/underflow; bit 6: anomaly in offset calculation; bit 5: anomaly in gain calculation; bit 4: pop detected; bit 3: DCR Occurred; bit 2: Moon in View; bit 1: telemetry out of limit condition; bit 0: unused (reserved)
CalFlag	8-bit unsigned integer	Channel (= 2378)	Bit field, by channel, for the current scanline. Zero means the channel was well calibrated, for this scanline. bit 7 (MSB): scene over/underflow; bit 6: anomaly in offset calculation; bit 5: anomaly in gain calculation; bit 4: pop detected; bit 3: DCR Occurred; bit 2: Moon in View; bit 1: telemetry out of limit condition; bit 0: unused (reserved)
SpaceViewDelta	32-bit floating-point	Channel (= 2378)	The mean of the four spaceviews immediately following the Earth views in the scanline, minus the mean of the spaceviews immediately preceding the Earth views in the scanline (also the magnitude of a "pop" in this scanline, when the "pop detected" bit is set in CalFlag.) (data numbers)
spaceview_selection	8-bit unsigned integer	None	Indicates which footprints were included for this scan. Each bit is high when the corresponding space view is used in the spaceview offset calculation. (See L1B Processing Requirements, section 6.2); LSB is first space view.
gain	32-bit floating-point	MaxRefChannel (= 100)	Gain: number of radiance units per count
OpMode	16-bit unsigned integer	None	Instrument Operations Mode. See AIRS Command Handbook, section 6.4 for a definition of each bit. bits 0 (LSB)-2 cal phase; bits 3-6 Cal Func; bit 7 quicklook (expedited) flag; bits 8-11 submode bits 12-14 Mode (0=standby, 1=ready, 2=operate, 3=checkout, 4=decontaminate, 5=off, 6=survival); bit 16 transition flag
DpCircCount	16-bit unsigned integer	None	Data Processing circumvention counts (active A or B) (counts)
DpCircBasThr	16-bit unsigned integer	None	Data Processing circumvention base threshold (active A or B)

Size: 1667925 bytes (1.7 MB) per 45-scanset granule

## Full Swath Data Fields

These fields appear for every footprint of every scanline in the granule (GeoTrack \* GeoXTrack times)

Name	Type	Extra Dimensions	Explanation
radiances	32-bit floating-point	Channel (= 2378)	Radiances for each channel in milliWatts/m**2/cm**-1/steradian
scanang	32-bit floating-point	None	Scanning angle of AIRS instrument with respect to the AIRS Instrument for this footprint (-180.0 ... 180.0, negative at start of scan, 0 at nadir)
ftptgeoqa	32-bit unsigned integer	None	Footprint Geolocation QA flags: bit 0 (LSB): bad input value; bit 1: PGS_TD_TAItoUTC() returned PGSTD_E_NO_LEAP_SECS; bit 2: PGS_TD_TAItoUTC() returned PGS_E_TOOLKIT; bit 3: PGS_CSC_GetFOV_Pixel() returned PGSCSC_W_MISS_EARTH; bit 4: PGS_CSC_GetFOV_Pixel() returned PGSTD_E_SC_TAG_UNKNOWN; bit 5: PGS_CSC_GetFOV_Pixel() returned PGSCSC_W_ZERO_PIXEL_VECTOR; bit 6: PGS_CSC_GetFOV_Pixel() returned PGSCSC_W_BAD_EPH_FOR_PIXEL; bit 7: PGS_CSC_GetFOV_Pixel() returned PGSCSC_W_INSTRUMENT_OFF_BOARD; bit 8: PGS_CSC_GetFOV_Pixel() returned PGSCSC_W_BAD_ACCURACY_FLAG; bit 9: PGS_CSC_GetFOV_Pixel() returned PGSCSC_E_BAD_ARRAY_SIZE; bit 10: PGS_CSC_GetFOV_Pixel() returned PGSCSC_W_DEFAULT_EARTH_MODEL; bit 11: PGS_CSC_GetFOV_Pixel() returned PGSCSC_W_DATA_FILE_MISSING; bit 12: PGS_CSC_GetFOV_Pixel() returned PGSCSC_E_NEG_OR_ZERO_RAD; bit 13: PGS_CSC_GetFOV_Pixel() returned PGSMEM_E_NO_MEMORY; bit 14: PGS_CSC_GetFOV_Pixel() returned PGSTD_E_NO_LEAP_SECS; bit 15: PGS_CSC_GetFOV_Pixel() returned PGSTD_E_TIME_FMT_ERROR; bit 16: PGS_CSC_GetFOV_Pixel() returned PGSTD_E_TIME_VALUE_ERROR; bit 17: PGS_CSC_GetFOV_Pixel() returned PGSCSC_W_PREDICTED_UT1; bit 18: PGS_CSC_GetFOV_Pixel() returned PGSTD_E_NO_UT1_VALUE; bit 19: PGS_CSC_GetFOV_Pixel() returned PGS_E_TOOLKIT; bit 20: PGS_CSC_GetFOV_Pixel() returned PGSEPH_E_BAD_EPHEM_FILE_HDR; bit 21: PGS_CSC_GetFOV_Pixel()

			returned PGSEPH_E_NO_SC_EPHEM_FILE; bit 22-31: not used
zengeoqa	16-bit unsigned integer	None	Satellite zenith Geolocation QA flags: bit 0 (LSB): (Spacecraft) bad input value; bit 1: PGS_CSC_ZenithAzimuth(S/C) returned PGSCSC_W_BELOW_HORIZON; bit 2: PGS_CSC_ZenithAzimuth(S/C) returned PGSCSC_W_UNDEFINED_AZIMUTH; bit 3: PGS_CSC_ZenithAzimuth(S/C) returned PGSCSC_W_NO_REFRACTION; bit 4: PGS_CSC_ZenithAzimuth(S/C) returned PGSCSC_E_INVALID_VECTAG; bit 5: PGS_CSC_ZenithAzimuth(S/C) returned PGSCSC_E_LOOK_PT_ALTIT_RANGE; bit 6: PGS_CSC_ZenithAzimuth(S/C) returned PGSCSC_E_ZERO_INPUT_VECTOR; bit 7: PGS_CSC_ZenithAzimuth(S/C) returned PGS_E_TOOLKIT; bit 8: (Sun) bad input value; bit 9: (suppressed) PGS_CSC_ZenithAzimuth(Sun) returned PGSCSC_W_BELOW_HORIZON (This is not an error condition - the sun is below the horizon at night); bit 10: PGS_CSC_ZenithAzimuth(Sun) returned PGSCSC_W_UNDEFINED_AZIMUTH; bit 11: PGS_CSC_ZenithAzimuth(Sun) returned PGSCSC_W_NO_REFRACTION; bit 12: PGS_CSC_ZenithAzimuth(Sun) returned PGSCSC_E_INVALID_VECTAG; bit 13: PGS_CSC_ZenithAzimuth(Sun) returned PGSCSC_E_LOOK_PT_ALTIT_RANGE; bit 14: PGS_CSC_ZenithAzimuth(Sun) returned PGSCSC_E_ZERO_INPUT_VECTOR; bit 15: PGS_CSC_ZenithAzimuth(Sun) returned PGS_E_TOOLKIT
demgeoqa	16-bit unsigned integer	None	Digital Elevation Model (DEM) Geolocation QA flags: bit 0 (LSB): bad input value; bit 1: Could not allocate memory; bit 2: Too close to North or South pole. Excluded; bit 3: Layer resolution incompatibility. Excluded; bit 4: Any DEM Routine (elev) returned PGSDM_E_IMPROPER_TAG; bit 5: Any DEM Routine (elev) returned PGSDM_E_CANNOT_ACCESS_DATA; bit 6: Any DEM Routine (land/water) returned PGSDM_E_IMPROPER_TAG; bit 7: Any DEM Routine (land/water) returned PGSDM_E_CANNOT_ACCESS_DATA; bit 8: Reserved for future layers; bit 9: Reserved for future layers; bit 10: PGS_DEM_GetRegion(elev) returned PGSDM_M_FILLVALUE_INCLUDED; bit 11: PGS_DEM_GetRegion(land/water) returned PGSDM_M_FILLVALUE_INCLUDED; bit 12: Reserved for future layers; bit 13: PGS_DEM_GetRegion(all) returned PGSDM_M_MULTIPLE_RESOLUTIONS; bit 14: PGS_CSC_GetFOV_Pixel() returned any 'W' class return code except PGSCSC_W_PREDICTED_UT1; bit 15: PGS_CSC_GetFOV_Pixel() returned any 'E' class return code
satzen	32-bit floating-point	None	Spacecraft zenith angle (0.0 ... 180.0) degrees from zenith (measured relative to the geodetic vertical on the reference (WGS84) spheroid and including corrections outlined in EOS SDP toolkit for normal accuracy.)
satazi	32-bit floating-point	None	Spacecraft azimuth angle (-180.0 ... 180.0) degrees E of N GEO)
solzen	32-bit floating-point	None	Solar zenith angle (0.0 ... 180.0) degrees from zenith (measured relative to the geodetic vertical on the reference (WGS84) spheroid and including corrections outlined in EOS SDP toolkit for normal accuracy.)
solazi	32-bit floating-point	None	Solar azimuth angle (-180.0 ... 180.0) degrees E of N GEO)
sun_glint_distance	16-bit integer	None	Distance (km) from footprint center to location of the sun glint (-9999 for unknown, 30000 for no glint visible because spacecraft is in Earth's shadow)
topog	32-bit floating-point	None	Mean topography in meters above reference ellipsoid
topog_err	32-bit floating-point	None	Error estimate for topog
landFrac	32-bit floating-point	None	Fraction of spot that is land (0.0 ... 1.0)
landFrac_err	32-bit floating-point	None	Error estimate for landFrac
state	32-bit integer	None	Data state: 0:Process, 1:Special, 2:Erroneous, 3:Missing
Rdiff_swindow	32-bit floating-point	None	Radiance difference in the 2560 cm <sup>-1</sup> window region used to warn of possible errors caused by scene non-uniformity and misalignment of the beams: radiance(Rdiff_swindow_M1a_chan) - radiance(Rdiff_swindow_M2a_chan). (radiance units)
Rdiff_lwindow	32-bit floating-point	None	Radiance difference in the longwave window(850 cm <sup>-1</sup> ) used to warn of possible errors caused by scene non-uniformity and misalignment of the beams: radiance(Rdiff_lwindow_M8_chan) - radiance(Rdiff_lwindow_M9_chan). (radiance units)
Rdiff_strat	32-bit floating-point	None	Radiance difference in the 2310 cm <sup>-1</sup> CO2 R-Branch temperature sounding region used to warn of possible errors caused by scene non-uniformity and misalignment of the beams: radiance(Rdiff_strat_M1b_chan) - radiance(Rdiff_strat_M2b_chan). (radiance units)
SceneInhomogeneous	8-bit unsigned integer	None	Threshold test for scene inhomogeneity, using band-overlap detectors (bit fields). bit 7 (MSB): scene is inhomogeneous, as determined by the Rdiff_swindow threshold bit 6: scene is inhomogeneous, as determined by the Rdiff_lwindow threshold bit 5: scene is inhomogeneous, as determined by the Rdiff_strat threshold bits 4-0: unused (reserved)

Size: 116336250 bytes (116.3 MB) per 45-scanset granule

**Total File Size (plus storage for dimensions and other HDF-EOS overhead):  
122072554 bytes (122.1 MB) per 45-scanset granule = 29297.4 MB per day**

## Special AIRS Types

Limited Engineering Struct: This type is used for engineering data fields for which there are known "yellow" limits

Field Name	Type	Explanation
min	32-bit floating-point	Minimum value field takes on in granule (not valid when num_in = 0)
max	32-bit floating-point	Maximum value field takes on in granule (not valid when num_in = 0)
mean	32-bit floating-point	Mean of in-range values field takes on in granule (not valid when num_in = 0)
dev	32-bit floating-point	Standard Deviation of in-range values field takes on in granule (not valid when num_in = 0)
num_in	32-bit integer	Count of in-range values field takes on in granule
num_lo	32-bit integer	Count of out-of-range low values field takes on in granule
num_hi	32-bit integer	Count of out-of-range high values field takes on in granule
num_bad	32-bit integer	Count of occasions on which field takes on invalid flag value (-9999) in granule
range_min	32-bit floating-point	Minimum in-range value. Any value less than this is counted in num_lo and is not used in the calculation of mean & dev.
range_max	32-bit floating-point	Maximum in-range value. Any value greater than this is counted in num_hi and is not used in the calculation of mean & dev.
missing	8-bit integer	Missing limits flags. Bit 0 (LSB) is 1 when yellow low (range_min) limit is missing; Bit 1 is high when yellow high (range_max) limit is missing; other bits unused, set to 0.
max_track	32-bit integer	GeoTrack index (counting from 1) where max was found
max_xtrack	32-bit integer	GeoXTrack index (counting from 1) where max was found
min_track	32-bit integer	GeoTrack index (counting from 1) where min was found
min_xtrack	32-bit integer	GeoXTrack index (counting from 1) where min was found

Unlimited Engineering Struct: This type is used for engineering data fields for which there are NOT known "yellow" limits

Field Name	Type	Explanation
min	32-bit floating-point	Minimum value field takes on in granule (not valid when num = 0)
max	32-bit floating-point	Maximum value field takes on in granule (not valid when num = 0)
mean	32-bit floating-point	Mean of values field takes on in granule (not valid when num = 0)
dev	32-bit floating-point	Standard Deviation of values field takes on in granule (not valid when num = 0)
num	32-bit integer	Count of occurrences of field in granule (not including those counted in num_bad)
num_bad	32-bit integer	Count of occasions on which field takes on invalid flag value (-9999) in granule
max_track	32-bit integer	GeoTrack index (counting from 1) where max was found
max_xtrack	32-bit integer	GeoXTrack index (counting from 1) where max was found
min_track	32-bit integer	GeoTrack index (counting from 1) where min was found
min_xtrack	32-bit integer	GeoXTrack index (counting from 1) where min was found

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## A-2. L1B AIRS QA Interface Specification

Interface Specification Version 3.0.4.0  
2003-05-19

ESDT ShortName = "AIRBQAP"

Swath Name = "L1B\_AIRS\_QA"

Level = "level1B"

# Footprints = 90

# scanlines per scanset = 3

### Dimensions

These fields define all dimensions that can be used for HDF-EOS swath fields.

The names "GeoTrack" and "GeoXTrack" have a special meaning for this document: "Cross-Track" data fields have a hidden dimension of "GeoXTrack"; "Along-Track" data fields have a hidden dimension of "GeoTrack"; "Full Swath Data Fields" have hidden dimensions of both "GeoTrack" and "GeoXTrack".

Name	Value	Explanation
GeoXTrack	90	Dimension across track for footprint positions. Same as number of footprints per scanline. -- starting at the left and increasing towards the right as you look along the satellite's path
GeoTrack	# of scan lines in swath	Dimension along track for footprint positions. Same as number of scanlines in granule. Parallel to the satellite's path, increasing with time. (Nominally 45 for Level-2, AMSU-A, and AIRS/Vis low-rate engineering; 135 for AIRS/Vis and HSB high-rate quantities)
CalXTrack	6	Dimension "across" track for calibration footprint positions. Same as number of calibration footprints per scanline. (NUM_FOOTPRINTS_AIRS_CALIB) (Footprints are ordered: 1-4: spaceviews (ports 3, 4, 1, 2); 5: blackbody radiometric calibration source; 6: spectral/photometric calibration sources)
SpaceXTrack	4	Dimension "across" track for spaceview calibration footprint positions in order of observation time. (NUM_FOOTPRINTS_AIRS_SPACE)
BBXTrack	1	Dimension "across" track for blackbody calibration footprint positions in order of observation time. (NUM_FOOTPRINTS_AIRS_BB)
Channel	2378	Dimension of channel array (Channels are generally in order of increasing wavenumber, but because frequencies can vary and because all detectors from a physical array of detector elements (a "module") are always grouped together there are sometimes small reversals in frequency order where modules overlap.)
MaxRefChannel	100	Maximum number of radiometric reference channels. "RefChannels" lists the channels used.
MaxFeaturesUpwell	35	Maximum number of spectral features in upwelling radiances used for spectral calibration
MaxFeaturesPary	17	Maximum number of spectral features in parylene radiances used for spectral calibration

### Geolocation Fields

These fields appear for every footprint (GeoTrack \* GeoXTrack times) and correspond to footprint center coordinates and "shutter" time.

Name	Explanation
Latitude	Footprint boresight geodetic Latitude in degrees North (-90.0 ... 90.0)
Longitude	Footprint boresight geodetic Longitude in degrees East (-180.0 ... 180.0)
Time	Footprint "shutter" TAI Time: floating-point elapsed seconds since Jan 1, 1993

Size: 291600 bytes (0.3 MB) per 45-scanset granule

### Attributes

These fields appear only once per granule

Name	Type	Extra Dimensions	Explanation
processing_level	string of 8-bit characters	None	Zero-terminated character string denoting processing level ("level1B")
instrument	string of 8-bit characters	None	Zero-terminated character string denoting instrument ("AIRS")
DayNightFlag	string of 8-bit characters	None	Zero-terminated character string denoting granule as day and/or night: (Always "Day", "Night", or "Both")
AutomaticQAFlag	string of 8-bit characters	None	Zero-terminated character string denoting granule data quality: (Always "Passed", "Failed", or "Suspect")
NumTotalData	32-bit integer	None	Total number of expected scene footprints
NumProcessData	32-bit integer	None	Number of scene footprints which are present and can be processed

			routinely (state = 0)
NumSpecialData	32-bit integer	None	Number of scene footprints which are present and can be processed only as a special test (state = 1)
NumBadData	32-bit integer	None	Number of scene footprints which are present but cannot be processed (state = 2)
NumMissingData	32-bit integer	None	Number of expected scene footprints which are not present (state = 3)
NumLandSurface	32-bit integer	None	Number of scene footprints for which the surface is more than 90% land
NumOceanSurface	32-bit integer	None	Number of scene footprints for which the surface is less than 10% land
node_type	string of 8-bit characters	None	Zero-terminated character string denoting whether granule is ascending, descending, or pole-crossing: ("Ascending" and "Descending" for entirely ascending or entirely descending granules, or "NorthPole" or "SouthPole" for pole-crossing granules)
start_year	32-bit integer	None	Year in which granule started, UTC (e.g. 1999)
start_month	32-bit integer	None	Month in which granule started, UTC (1 ... 12)
start_day	32-bit integer	None	Day of month in which granule started, UTC (1 ... 31)
start_hour	32-bit integer	None	Hour of day in which granule started, UTC (0 ... 23)
start_minute	32-bit integer	None	Minute of hour in which granule started, UTC (0 ... 59)
start_sec	32-bit floating-point	None	Second of minute in which granule started, UTC (0.0 ... 59.0)
start_orbit	32-bit integer	None	Orbit number of mission in which granule started
end_orbit	32-bit integer	None	Orbit number of mission in which granule ended
orbit_path	32-bit integer	None	Orbit path of start orbit (1 ... 233 as defined by EOS project)
start_orbit_row	32-bit integer	None	Orbit row at start of granule (1 ... 248 as defined by EOS project)
end_orbit_row	32-bit integer	None	Orbit row at end of granule (1 ... 248 as defined by EOS project)
granule_number	32-bit integer	None	Number of granule within day (1 ... 240)
num_scansets	32-bit integer	None	Number of scansets in granule (1 ... 45)
num_scanlines	32-bit integer	None	Number of scanlines in granule (3 * num_scansets)
start_Latitude	64-bit floating-point	None	Geodetic Latitude of spacecraft at start of granule in degrees North (-90.0 ... 90.0)
start_Longitude	64-bit floating-point	None	Geodetic Longitude of spacecraft at start of granule in degrees East (-180.0 ... 180.0)
start_Time	64-bit floating-point	None	TAI Time at start of granule (floating-point elapsed seconds since start of 1993)
end_Latitude	64-bit floating-point	None	Geodetic Latitude of spacecraft at end of granule in degrees North (-90.0 ... 90.0)
end_Longitude	64-bit floating-point	None	Geodetic Longitude of spacecraft at end of granule in degrees East (-180.0 ... 180.0)
end_Time	64-bit floating-point	None	TAI Time at end of granule (floating-point elapsed seconds since start of 1993)
eq_x_longitude	32-bit floating-point	None	Longitude of spacecraft at southward equator crossing nearest granule start in degrees East (-180.0 ... 180.0)
eq_x_tai	64-bit floating-point	None	Time of eq_x_longitude in TAI units (floating-point elapsed seconds since start of 1993)
orbitgeoqa	32-bit unsigned integer	None	Orbit Geolocation QA: bit 0 (LSB): bad input value (last scanline); bit 1: bad input value (first scanline); bit 2: PGS_EPH_GetEphMet() returned PGSEPH_E_NO_SC_EPHEM_FILE; bit 3: PGS_EPH_GetEphMet() returned PGSEPH_E_BAD_ARRAY_SIZE; bit 4: PGS_EPH_GetEphMet() returned PGSTD_E_TIME_FMT_ERROR; bit 5: PGS_EPH_GetEphMet() returned PGSTD_E_TIME_VALUE_ERROR; bit 6: PGS_EPH_GetEphMet() returned PGSTD_E_SC_TAG_UNKNOWN; bit 7: PGS_EPH_GetEphMet() returned PGS_E_TOOLKIT; bit 8: PGS_TD_UTCtoTAI() returned PGSTD_E_NO_LEAP_SECS; bit 9: PGS_TD_UTCtoTAI() returned PGSTD_E_TIME_FMT_ERROR; bit 10: PGS_TD_UTCtoTAI() returned PGSTD_E_TIME_VALUE_ERROR; bit 11: PGS_TD_UTCtoTAI() returned PGS_E_TOOLKIT; bit 12: PGS_CSC_DayNight() returned PGSTD_E_NO_LEAP_SECS; bit 13: PGS_CSC_DayNight() returned PGSCSC_E_INVALID_LIMITTAG; bit 14: PGS_CSC_DayNight() returned PGSCSC_E_BAD_ARRAY_SIZE; bit 15: PGS_CSC_DayNight() returned PGSCSC_W_ERROR_IN_DAYNIGHT; bit 16: PGS_CSC_DayNight() returned PGSCSC_W_BAD_TRANSFORM_VALUE; bit 17: PGS_CSC_DayNight() returned PGSCSC_W_BELOW_HORIZON; bit 18: PGS_CSC_DayNight() returned PGSCSC_W_PREDICTED_UT1; bit 19: PGS_CSC_DayNight() returned PGSTD_E_NO_UT1_VALUE; bit 20: PGS_CSC_DayNight() returned PGSTD_E_BAD_INITIAL_TIME; bit 21: PGS_CSC_DayNight() returned PGSCBP_E_TIME_OUT_OF_RANGE; bit 22: PGS_CSC_DayNight() returned



			PGSCBP E UNABLE TO OPEN FILE; bit 22: PGS_CSC_DayNight() returned PGSMEM E NO MEMORY; bit 24: PGS_CSC_DayNight() returned PGS_E_TOOLKIT; bit 25-31: not used
num_satgeoqa	16-bit integer	None	Number of scans with problems in satgeoqa
num_glintgeoqa	16-bit integer	None	Number of scans with problems in glintgeoqa
num_moongeoqa	16-bit integer	None	Number of scans with problems in moongeoqa
num_ftptgeoqa	16-bit integer	None	Number of footprints with problems in ftptgeoqa
num_zengeoqa	16-bit integer	None	Number of footprints with problems in zengeoqa
num_demgeoqa	16-bit integer	None	Number of footprints with problems in demgeoqa
num_fpe	16-bit integer	None	Number of floating point errors
LonGranuleCen	16-bit integer	None	Geodetic Longitude of the center of the granule in degrees East (-180 ... 180)
LatGranuleCen	16-bit integer	None	Geodetic Latitude of the center of the granule in degrees North (-90 ... 90)
LocTimeGranuleCen	16-bit integer	None	Local solar time at the center of the granule in minutes past midnight (0 ... 1439)
CalGranSummary	8-bit unsigned integer	None	Bit field. Bitwise OR of CalChanSummary, over all good channels (see ExcludedChans). Zero means all good channels were well calibrated, for all scanlines. bit 7 (MSB): scene over/underflow; bit 6: anomaly in offset calculation; bit 5: anomaly in gain calculation; bit 4: pop detected; bit 3: noise out of bounds; bit 2: anomaly in spectral calibration; bit 1: Telemetry; bit 0: unused (reserved);
CalChanSummary	8-bit unsigned integer	Channel (= 2378)	Bit field. Bitwise OR of CalFlag, by channel, over all scanlines. Noise threshold and spectral quality added. Zero means the channel was well calibrated for all scanlines bit 7 (MSB): scene over/underflow; bit 6: anomaly in offset calculation; bit 5: anomaly in gain calculation; bit 4: pop detected; bit 3: noise out of bounds; bit 2: anomaly in spectral calibration; bit 1: Telemetry; bit 0: unused (reserved);
ExcludedChans	8-bit unsigned integer	Channel (= 2378)	An integer 0-6, indicating A/B detector weights. Used in L1B processing. 0 - A weight = B weight. Probably better than channels with state > 2; 1 - A-side only. Probably better than channels with state > 2; 2 - B-side only. Probably better than channels with state > 2; 3 - A weight = B weight. Probably better than channels with state = 6; 4 - A-side only. Probably better than channels with state = 6; 5 - B-side only. Probably better than channels with state = 6; 6 - A weight = B weight.
NeN	32-bit floating-point	Channel (= 2378)	Noise-equivalent Radiance (radiance units) for an assumed 250K scene
DCR_scan	16-bit integer	None	Scanline number of (first) DC-Restore. 0 for no DC-Restore
input_scene_counts	Limited Engineering Struct (see below)	Channel (= 2378)	Input statistics on scene data numbers
input_space_counts	Limited Engineering Struct (see below)	SpaceXTrack (= 4) * Channel (= 2378)	Input statistics on spaceview data numbers
input_space_signals	Limited Engineering Struct (see below)	SpaceXTrack (= 4) * Channel (= 2378)	Input statistics on spaceview signals (data numbers with offset subtracted)
input_space_diffs	Unlimited Engineering Struct (see below)	SpaceXTrack (= 4) * Channel (= 2378)	Statistics on differences between corresponding space views, for consecutive scanlines
input_bb_counts	Limited Engineering Struct (see below)	Channel (= 2378)	Input statistics on blackbody calibration data numbers
input_bb_signals	Limited Engineering Struct (see below)	Channel (= 2378)	Input statistics on blackbody calibration signals (data numbers with offset subtracted)
input_spec_counts	Limited Engineering Struct (see below)	Channel (= 2378)	Input statistics on spectral calibration data numbers
input_bb_temp	Limited Engineering Struct (see below)	None	Input statistics on Blackbody temperature
input_bb_temp1	Limited	None	Input statistics on Blackbody temperature 1A (CaRbTempV1A or

	Engineering Struct (see below)		CaBbTempV1B, as active)
input_bb_temp2	Limited Engineering Struct (see below)	None	Input statistics on Blackbody temperature 2 (CaBbTempV2A or CaBbTempV2B, as active)
input_bb_temp3	Limited Engineering Struct (see below)	None	Input statistics on Blackbody temperature 3 (CaBbTemp3, active A or B)
input_bb_temp4	Limited Engineering Struct (see below)	None	Input statistics on Blackbody temperature4 (CaBbTemp4, active A or B)
input_spec_temp	Limited Engineering Struct (see below)	None	Input statistics on Spectrometer temperature
input_ir_det_temp	Limited Engineering Struct (see below)	None	Input statistics on IR detector temperature
input_grating_temp_1	Limited Engineering Struct (see below)	None	Input statistics on Grating temperature 1 (SpGratngTemp1, active A or B)
input_grating_temp_2	Limited Engineering Struct (see below)	None	Input statistics on Grating temperature 2 (SpGratngTemp2, active A or B)
input_entr_filt_temp	Limited Engineering Struct (see below)	None	Input statistics on the entrance filter temperature (SpEntFiltTmp, active A or B)
input_opt_bench_temp_2	Limited Engineering Struct (see below)	None	Input statistics on optical bench temperature 2 (SpOptBnchTmp2, active A or B)
input_opt_bench_temp_3	Limited Engineering Struct (see below)	None	Input statistics on optical bench temperature 3 (SpOptBnchTmp3, active A or B)
input_scan_mirror_temp	Limited Engineering Struct (see below)	None	Input statistics on scan mirror housing temperature
input_chopper_phase_err	Limited Engineering Struct (see below)	None	Input statistics on chopper phase error voltage (ChPhaseErrVA or ChPhaseErrVB, as active)
PopCount	32-bit integer	None	Number of popcorn events within granule, i.e. number of times than an AIRS channel used in the Level 2 retrieval has suffered a sudden discontinuity in dark current
offset_stats	Unlimited Engineering Struct (see below)	Channel (= 2378)	Statistics on offsets
gain_stats	Unlimited Engineering Struct (see below)	Channel (= 2378)	Statistics on gains
rad_stats	Unlimited Engineering Struct (see below)	Channel (= 2378)	Statistics on radiances (radiance units)
NumRefChannels	32-bit integer	None	The number of channels reported in MaxRefChannel arrays
RefChannels	32-bit integer	MaxRefChannel (= 100)	The 1-based indexes of channels reported in MaxRefChannel arrays
rad_scan_stats	Unlimited Engineering Struct (see below)	GeoXTrack (= 90) * MaxRefChannel (= 100)	Statistics on scan angle dependence of radiances
Rdiff_swindow_M1a_chan	16-bit integer	None	Arrav M1a channel used as one reference in calculating Rdiff swindow

			(index into radiance & frequency arrays 1...2378)
Rdiff_swindow_M2a_chan	16-bit integer	None	Array M2a channel used as one reference in calculating Rdiff_swindow. (index into radiance & frequency arrays 1...2378)
Rdiff_lwindow_M8_chan	16-bit integer	None	Array M8 channel used as one reference in calculating Rdiff_lwindow. (index into radiance & frequency arrays 1...2378)
Rdiff_lwindow_M9_chan	16-bit integer	None	Array M9 channel used as one reference in calculating Rdiff_lwindow. (index into radiance & frequency arrays 1...2378)
Rdiff_strat_M2b_chan	16-bit integer	None	Array M2b channel used as one reference in calculating Rdiff_strat. (index into radiance & frequency arrays 1...2378)
Rdiff_strat_M1b_chan	16-bit integer	None	Array M1b channel used as one reference in calculating Rdiff_strat. (index into radiance & frequency arrays 1...2378)
granules_present	string of 8-bit characters	None	Zero-terminated character string denoting which adjacent granules were available for smoothing ("All" for both previous & next, "Prev" for previous but not next, "Next" for next but not previous, "None" for neither previous nor next)
spectral_TAI	64-bit floating-point	None	TAI time of (first) Spectral calibration. (floating-point elapsed seconds since start of 1993) 0 for no Spectral calibration occurred in this granule.
nominal_freq	32-bit floating-point	Channel (= 2378)	Nominal frequencies (in cm <sup>-1</sup> ) of each channel
spectral_freq	32-bit floating-point	Channel (= 2378)	Calculated frequencies (in cm <sup>-1</sup> )
spectral_freq_unc	32-bit floating-point	Channel (= 2378)	Uncertainty in calculated frequencies (in cm <sup>-1</sup> )
spec_shift_upwell	32-bit floating-point	None	Focal plane shift calculated in grating model fit to upwelling radiances (microns)
spec_shift_unc_upwell	32-bit floating-point	None	Uncertainty of the focal plane shift calculated in the grating model fit to upwelling radiances (microns)
spec_fl_upwell	32-bit floating-point	None	Focal length calculated in grating model fit to upwelling radiances (microns)
spec_fl_unc_upwell	32-bit floating-point	None	Uncertainty of focal length calculated in grating model fit to upwelling radiances (microns)
SpectralFeaturesUpwell	32-bit integer	None	The actual number of upwelling features for MaxFeaturesUpwell-sized arrays
spec_feature_shifts_upwell	32-bit floating-point	MaxFeaturesUpwell (= 35)	Spectral shift seen for each upwelling feature, in microns at the focal plane
spec_feature_corr_upwell	32-bit floating-point	MaxFeaturesUpwell (= 35)	Maximum correlation seen for each upwelling feature (0.0 ... 1.0)
spec_feature_sharp_upwell	32-bit floating-point	MaxFeaturesUpwell (= 35)	Quadratic coefficient in fit to correlation for each upwelling feature
spec_feature_resid_upwell	32-bit floating-point	MaxFeaturesUpwell (= 35)	Fit residual for each upwelling feature (wavenumbers)
spec_iter_upwell	16-bit integer	None	Number of amoeba iterations to fit the grating model to upwelling radiance feature positions
spec_feature_contrast_stats	Limited Engineering Struct (see below)	MaxFeaturesUpwell (= 35)	Statistics on the spectral contrasts for each of the upwelling features, for each of the scene footprints considered for spectral calibration
spec_clim_select	16-bit integer	None	Number of the climatology to which the upwelling features were fitted
spec_shift_pary	32-bit floating-point	None	Focal plane shift calculated in grating model fit to parylene radiances (microns)
spec_shift_unc_pary	32-bit floating-point	None	Uncertainty of the focal plane shift calculated in grating model fit to parylene radiances (microns)
spec_fl_pary	32-bit floating-point	None	Focal length calculated in grating model fit to parylene radiances (microns)
spec_fl_unc_pary	32-bit floating-point	None	Uncertainty of focal length calculated in grating model fit to parylene radiances (microns)
SpectralFeaturesPary	32-bit integer	None	The actual number of parylene features for MaxFeaturesPary-sized arrays
spec_feature_shifts_pary	32-bit floating-point	MaxFeaturesPary (= 17)	Spectral shift seen for each parylene feature, in microns at the focal plane
spec_feature_corr_pary	32-bit floating-point	MaxFeaturesPary (= 17)	Maximum correlation seen for each parylene feature (0.0 ... 1.0)
spec_feature_sharp_pary	32-bit floating-point	MaxFeaturesPary (= 17)	Quadratic coefficient in fit to correlation for each parylene feature
spec_feature_resid_pary	32-bit floating-point	MaxFeaturesPary (= 17)	Fit residual for each parylene feature (wavenumbers)

	point	17)	
spec_iter_pary	16-bit integer	None	Number of amoeba iterations in fit the grating model to parylene radiance feature positions
ave_pary_spectrum	32-bit floating-point	Channel (= 2378)	The average parylene spectrum (over good scanlines), in milliWatts/m**2/cm**-1/steradian
DCRCOUNT	32-bit integer	None	Number of times a Direct Current Restore was executed for any module

Size: 3776779 bytes (3.8 MB) per granule

## Along-Track Data Fields

These fields appear once per scanline (GeoTrack times)

Name	Type	Extra Dimensions	Explanation
satheight	32-bit floating-point	None	Satellite altitude at nadirTAI in km above reference ellipsoid (e.g. 725.2)
satroll	32-bit floating-point	None	Satellite attitude roll angle at nadirTAI (-180.0 ... 180.0 angle about the +x (roll) ORB axis, +x axis is positively oriented in the direction of orbital flight completing an orthogonal triad with y and z.)
satpitch	32-bit floating-point	None	Satellite attitude pitch angle at nadirTAI (-180.0 ... 180.0 angle about +y (pitch) ORB axis, +y axis is oriented normal to the orbit plane with the positive sense opposite to that of the orbit's angular momentum vector H.)
satyaw	32-bit floating-point	None	Satellite attitude yaw angle at nadirTAI (-180.0 ... 180.0 angle about +z (yaw) axis, +z axis is positively oriented earthward parallel to the satellite radius vector R from the spacecraft center of mass to the center of the Earth.)
satgeoqa	32-bit unsigned integer	None	Satellite Geolocation QA flags: bit 0 (LSB): bad input value; bit 1: PGS_TD_TAtoUTC() returned PGSTD_E_NO_LEAP_SECS; bit 2: PGS_TD_TAtoUTC() returned PGS_E_TOOLKIT; bit 3: PGS_EPH_EphemAttit() returned PGSEPH_W_BAD_EPHEM_VALUE; bit 4: PGS_EPH_EphemAttit() returned PGSEPH_E_BAD_EPHEM_FILE_HDR; bit 5: PGS_EPH_EphemAttit() returned PGSEPH_E_NO_SC_EPHEM_FILE; bit 6: PGS_EPH_EphemAttit() returned PGSEPH_E_NO_DATA_REQUESTED; bit 7: PGS_EPH_EphemAttit() returned PGSTD_E_SC_TAG_UNKNOWN; bit 8: PGS_EPH_EphemAttit() returned PGSEPH_E_BAD_ARRAY_SIZE; bit 9: PGS_EPH_EphemAttit() returned PGSTD_E_TIME_FMT_ERROR; bit 10: PGS_EPH_EphemAttit() returned PGSTD_E_TIME_VALUE_ERROR; bit 11: PGS_EPH_EphemAttit() returned PGSTD_E_NO_LEAP_SECS; bit 12: PGS_EPH_EphemAttit() returned PGS_E_TOOLKIT; bit 13: PGS_CSC_ECtoECR() returned PGSCSC_W_BAD_TRANSFORM_VALUE; bit 14: PGS_CSC_ECtoECR() returned PGSCSC_E_BAD_ARRAY_SIZE; bit 15: PGS_CSC_ECtoECR() returned PGSTD_E_NO_LEAP_SECS; bit 16: PGS_CSC_ECtoECR() returned PGSTD_E_TIME_FMT_ERROR; bit 17: PGS_CSC_ECtoECR() returned PGSTD_E_TIME_VALUE_ERROR; bit 18: unused (set to zero); bit 19: PGS_CSC_ECtoECR() returned PGSTD_E_NO_UT1_VALUE; bit 20: PGS_CSC_ECtoECR() returned PGS_E_TOOLKIT; bit 21: PGS_CSC_ECRtoGEO() returned PGSCSC_W_TOO_MANY_ITERS; bit 22: PGS_CSC_ECRtoGEO() returned PGSCSC_W_INVALID_ALTITUDE; bit 23: PGS_CSC_ECRtoGEO() returned PGSCSC_W_SPHERE_BODY; bit 24: PGS_CSC_ECRtoGEO() returned PGSCSC_W_LARGE_FLATTENING; bit 25: PGS_CSC_ECRtoGEO() returned PGSCSC_W_DEFAULT_EARTH_MODEL; bit 26: PGS_CSC_ECRtoGEO() returned PGSCSC_E_BAD_EARTH_MODEL; bit 27: PGS_CSC_ECRtoGEO() returned PGS_E_TOOLKIT; bit 28-31: not used
glintgeoqa	16-bit unsigned integer	None	Glint Geolocation QA flags: bit 0 (LSB): bad input value; bit 1: glint location in Earth's shadow; bit 2: glint calculation not converging; bit 3: glint location sun vs. satellite zenith mismatch; bit 4: glint location sun vs. satellite azimuth mismatch; bit 5: bad glint location; bit 6: PGS_CSC_ZenithAzimuth() returned any 'W' class return code; bit 7: PGS_CSC_ZenithAzimuth() returned any 'E' class return code; bit 8: PGS_CBP_Earth_CB_Vector() returned any 'W' class return code; bit 9: PGS_CBP_Earth_CB_Vector() returned any 'E' class return code; bit 10: PGS_CSC_ECtoECR() returned any 'W' class return code except PGSCSC_W_PREDICTED_UT1 (for Glint); bit 11: PGS_CSC_ECtoECR() returned any 'E' class return code (for Glint); bit 12: PGS_CSC_ECRtoGEO() returned any 'W' class return code (for Glint); bit 13: PGS_CSC_ECRtoGEO() returned any 'E' class return code (for Glint); bit 14: PGS_CSC_ECtoECR() returned any 'W' class return code except PGSCSC_W_PREDICTED_UT1 ; bit 15: PGS_CSC_ECtoECR() returned any 'E' class return code
moongeoa	16-bit unsigned integer	None	Moon Geolocation QA flags: bit 0 (LSB): bad input value; bit 1: PGS_TD_TAtoUTC() returned PGSTD_E_NO_LEAP_SECS; bit 2: PGS_TD_TAtoUTC() returned PGS_E_TOOLKIT; bit 3: PGS_CBP_Sat_CB_Vector() returned PGSCBP_W_BELOW_SURFACE; bit 4: PGS_CBP_Sat_CB_Vector() returned PGSCBP_W_BAD_CB_VECTOR; bit 5: PGS_CBP_Sat_CB_Vector() returned PGSCBP_E_BAD_ARRAY_SIZE; bit 6: PGS_CBP_Sat_CB_Vector() returned PGSCBP_E_INVALID_CB_ID; bit 7: PGS_CBP_Sat_CB_Vector() returned PGSCBP_E_NO_MEMORY; bit 8: PGS_CBP_Sat_CB_Vector() returned PGSCBP_E_UNABLE_TO_OPEN_FILE; bit 9: PGS_CBP_Sat_CB_Vector() returned PGSTD_E_BAD_INITIAL_TIME; bit 10: PGS_CBP_Sat_CB_Vector() returned PGSCBP_E_TIME_OUT_OF_RANGE; bit 11: PGS_CBP_Sat_CB_Vector() returned PGSTD_E_SC_TAG_UNKNOWN; bit 12: PGS_CBP_Sat_CB_Vector() returned PGSEPH_E_BAD_EPHEM_FILE_HDR; bit 13: PGS_CBP_Sat_CB_Vector() returned PGSEPH_E_NO_SC_EPHEM_FILE; bit 14: PGS_CBP_Sat_CB_Vector() returned PGS_E_TOOLKIT; bit 15: not used

nadirTAI	64-bit floating-point	None	TAI time at which instrument is nominally looking directly down. (between footprints 15 & 16 for AMSU or between footprints 45 & 46 for AIRS/Vis & HSB) (floating-point elapsed seconds since start of 1993)
sat_lat	64-bit floating-point	None	Satellite geodetic latitude in degrees North (-90.0 ... 90.0)
sat_lon	64-bit floating-point	None	Satellite geodetic longitude in degrees East (-180.0 ... 180.0)
scan_node_type	8-bit integer	None	'A' for ascending, 'D' for descending, 'N' for North-Polar, 'S' for South-Polar
glintlat	32-bit floating-point	None	Solar glint geodetic latitude in degrees North at nadirTAI (-90.0 ... 90.0)
glintlon	32-bit floating-point	None	Solar glint geodetic longitude in degrees East at nadirTAI (-180.0 ... 180.0)
CalScanSummary	8-bit unsigned integer	None	Bit field. Bitwise OR of CalFlag over the good channel list (see ExcludedChans). Zero means all "good" channels were well calibrated for this scanline bit 7 (MSB): scene over/underflow; bit 6: anomaly in offset calculation; bit 5: anomaly in gain calculation; bit 4: pop detected; bit 3: DCR Occurred; bit 2: Moon in View; bit 1: telemetry out of limit condition; bit 0: unused (reserved)
CalFlag	8-bit unsigned integer	Channel (= 2378)	Bit field, by channel, for the current scanline. Zero means the channel was well calibrated, for this scanline. bit 7 (MSB): scene over/underflow; bit 6: anomaly in offset calculation; bit 5: anomaly in gain calculation; bit 4: pop detected; bit 3: DCR Occurred; bit 2: Moon in View; bit 1: telemetry out of limit condition; bit 0: unused (reserved)
SpaceViewDelta	32-bit floating-point	Channel (= 2378)	The mean of the four spaceviews immediately following the Earth views in the scanline, minus the mean of the spaceviews immediately preceding the Earth views in the scanline (also the magnitude of a "pop" in this scanline, when the "pop detected" bit is set in CalFlag.) (data numbers)
spaceview_selection	8-bit unsigned integer	None	Indicates which footprints were included for this scan. Each bit is high when the corresponding space view is used in the spaceview offset calculation. (See L1B Processing Requirements, section 6.2); LSB is first space view.
gain	32-bit floating-point	MaxRefChannel (= 100)	Gain: number of radiance units per count
OpMode	16-bit unsigned integer	None	Instrument Operations Mode. See AIRS Command Handbook, section 6.4 for a definition of each bit. bits 0 (LSB)-2 cal phase; bits 3-6 Cal Func; bit 7 quicklook (expedited) flag; bits 8-11 submode bits 12-14 Mode (0=standby, 1=ready, 2=operate, 3=checkout, 4=decontaminate, 5=off, 6=survival); bit 16 transition flag
DpCircCount	16-bit unsigned integer	None	Data Processing circumvention counts (active A or B) (counts)
DpCircBasThr	16-bit unsigned integer	None	Data Processing circumvention base threshold (active A or B)

Size: 1667925 bytes (1.7 MB) per 45-scanset granule

## Full Swath Data Fields

These fields appear for every footprint of every scanline in the granule (GeoTrack \* GeoXTrack times)

Name	Type	Extra Dimensions	Explanation
scanang	32-bit floating-point	None	Scanning angle of AIRS instrument with respect to the AIRS Instrument for this footprint (-180.0 ... 180.0, negative at start of scan, 0 at nadir)
ftptgeoqa	32-bit unsigned integer	None	Footprint Geolocation QA flags: bit 0 (LSB): bad input value; bit 1: PGS_TD_TAItUTC() returned PGSTD_E_NO_LEAP_SECS; bit 2: PGS_TD_TAItUTC() returned PGS_E_TOOLKIT; bit 3: PGS_CSC_GetFOV_Pixel() returned PGSCSC_W_MISS_EARTH; bit 4: PGS_CSC_GetFOV_Pixel() returned PGSTD_E_SC_TAG_UNKNOWN; bit 5: PGS_CSC_GetFOV_Pixel() returned PGSCSC_W_ZERO_PIXEL_VECTOR; bit 6: PGS_CSC_GetFOV_Pixel() returned PGSCSC_W_BAD_EPH_FOR_PIXEL; bit 7: PGS_CSC_GetFOV_Pixel() returned PGSCSC_W_INSTRUMENT_OFF_BOARD; bit 8: PGS_CSC_GetFOV_Pixel() returned PGSCSC_W_BAD_ACCURACY_FLAG; bit 9: PGS_CSC_GetFOV_Pixel() returned PGSCSC_E_BAD_ARRAY_SIZE; bit 10: PGS_CSC_GetFOV_Pixel() returned PGSCSC_W_DEFAULT_EARTH_MODEL; bit 11: PGS_CSC_GetFOV_Pixel() returned PGSCSC_W_DATA_FILE_MISSING; bit 12: PGS_CSC_GetFOV_Pixel() returned PGSCSC_E_NEG_OR_ZERO_RAD; bit 13: PGS_CSC_GetFOV_Pixel() returned PGSMEM_E_NO_MEMORY; bit 14: PGS_CSC_GetFOV_Pixel() returned PGSTD_E_NO_LEAP_SECS; bit 15: PGS_CSC_GetFOV_Pixel() returned PGSTD_E_TIME_FMT_ERROR; bit 16: PGS_CSC_GetFOV_Pixel() returned PGSTD_E_TIME_VALUE_ERROR; bit 17: PGS_CSC_GetFOV_Pixel() returned PGSCSC_W_PREDICTED_UT1; bit 18: PGS_CSC_GetFOV_Pixel() returned PGSTD_E_NO_UT1_VALUE; bit 19: PGS_CSC_GetFOV_Pixel() returned PGS_E_TOOLKIT; bit 20: PGS_CSC_GetFOV_Pixel() returned PGSEPH_E_BAD_EPHEM_FILE_HDR; bit 21: PGS_CSC_GetFOV_Pixel() returned PGSEPH_E_NO_SC_EPHEM_FILE; bit 22-31: not used
zengeoqa	16-bit unsigned integer	None	Satellite zenith Geolocation QA flags: bit 0 (LSB): (Spacecraft) bad input value; bit 1: PGS_CSC_ZenithAzimuth(S/C) returned PGSCSC_W_BELOW_HORIZON; bit 2: PGS_CSC_ZenithAzimuth(S/C) returned PGSCSC_W_UNDEFINED_AZIMUTH; bit 3: PGS_CSC_ZenithAzimuth(S/C) returned PGSCSC_W_NO_REFRACTION; bit 4: PGS_CSC_ZenithAzimuth(S/C) returned PGSCSC_E_INVALID_VECTAG; bit 5:

			PGS_CSC_ZenithAzimuth(S/C) returned PGSCSC_E_LOOK_PT_ALTIT_RANGE; bit 6: PGS_CSC_ZenithAzimuth(S/C) returned PGSCSC_E_ZERO_INPUT_VECTOR; bit 7: PGS_CSC_ZenithAzimuth(S/C) returned PGS_E_TOOLKIT; bit 8: (Sun) bad input value; bit 9: (suppressed) PGS_CSC_ZenithAzimuth(Sun) returned PGSCSC_W_BELOW_HORIZON (This is not an error condition - the sun is below the horizon at night); bit 10: PGS_CSC_ZenithAzimuth(Sun) returned PGSCSC_W_UNDEFINED_AZIMUTH; bit 11: PGS_CSC_ZenithAzimuth(Sun) returned PGSCSC_W_NO_REFRACTION; bit 12: PGS_CSC_ZenithAzimuth(Sun) returned PGSCSC_E_INVALID_VECTAG; bit 13: PGS_CSC_ZenithAzimuth(Sun) returned PGSCSC_E_LOOK_PT_ALTIT_RANGE; bit 14: PGS_CSC_ZenithAzimuth(Sun) returned PGSCSC_E_ZERO_INPUT_VECTOR; bit 15: PGS_CSC_ZenithAzimuth(Sun) returned PGS_E_TOOLKIT
demgeoqa	16-bit unsigned integer	None	Digital Elevation Model (DEM) Geolocation QA flags: bit 0 (LSB): bad input value; bit 1: Could not allocate memory; bit 2: Too close to North or South pole. Excluded; bit 3: Layer resolution incompatibility. Excluded; bit 4: Any DEM Routine (elev) returned PGSDM_E_IMPROPER_TAG; bit 5: Any DEM Routine (elev) returned PGSDM_E_CANNOT_ACCESS_DATA; bit 6: Any DEM Routine (land/water) returned PGSDM_E_IMPROPER_TAG; bit 7: Any DEM Routine (land/water) returned PGSDM_E_CANNOT_ACCESS_DATA; bit 8: Reserved for future layers; bit 9: Reserved for future layers; bit 10: PGS_DEM_GetRegion(elev) returned PGSDM_M_FILLVALUE_INCLUDED; bit 11: PGS_DEM_GetRegion(land/water) returned PGSDM_M_FILLVALUE_INCLUDED; bit 12: Reserved for future layers; bit 13: PGS_DEM_GetRegion(all) returned PGSDM_M_MULTIPLE_RESOLUTIONS; bit 14: PGS_CSC_GetFOV_Pixel() returned any 'W' class return code except PGSCSC_W_PREDICTED_UT1; bit 15: PGS_CSC_GetFOV_Pixel() returned any 'E' class return code
satzen	32-bit floating-point	None	Spacecraft zenith angle (0.0 ... 180.0) degrees from zenith (measured relative to the geodetic vertical on the reference (WGS84) spheroid and including corrections outlined in EOS SDP toolkit for normal accuracy.)
satazi	32-bit floating-point	None	Spacecraft azimuth angle (-180.0 ... 180.0) degrees E of N GEO)
solzen	32-bit floating-point	None	Solar zenith angle (0.0 ... 180.0) degrees from zenith (measured relative to the geodetic vertical on the reference (WGS84) spheroid and including corrections outlined in EOS SDP toolkit for normal accuracy.)
solazi	32-bit floating-point	None	Solar azimuth angle (-180.0 ... 180.0) degrees E of N GEO)
sun_glint_distance	16-bit integer	None	Distance (km) from footprint center to location of the sun glint (-9999 for unknown, 30000 for no glint visible because spacecraft is in Earth's shadow)
topog	32-bit floating-point	None	Mean topography in meters above reference ellipsoid
topog_err	32-bit floating-point	None	Error estimate for topog
landFrac	32-bit floating-point	None	Fraction of spot that is land (0.0 ... 1.0)
landFrac_err	32-bit floating-point	None	Error estimate for landFrac
state	32-bit integer	None	Data state: 0:Process, 1:Special, 2:Erroneous, 3:Missing
Rdiff_swindow	32-bit floating-point	None	Radiance difference in the 2560 cm <sup>-1</sup> window region used to warn of possible errors caused by scene non-uniformity and misalignment of the beams: radiance(Rdiff_swindow_M1a_chan) - radiance(Rdiff_swindow_M2a_chan). (radiance units)
Rdiff_lwindow	32-bit floating-point	None	Radiance difference in the longwave window(850 cm <sup>-1</sup> ) used to warn of possible errors caused by scene non-uniformity and misalignment of the beams: radiance(Rdiff_lwindow_M8_chan) - radiance(Rdiff_lwindow_M9_chan). (radiance units)
Rdiff_strat	32-bit floating-point	None	Radiance difference in the 2310 cm <sup>-1</sup> CO2 R-Branch temperature sounding region used to warn of possible errors caused by scene non-uniformity and misalignment of the beams: radiance(Rdiff_strat_M1b_chan) - radiance(Rdiff_strat_M2b_chan). (radiance units)
SceneInhomogeneous	8-bit unsigned integer	None	Threshold test for scene inhomogeneity, using band-overlap detectors (bit fields). bit 7 (MSB): scene is inhomogeneous, as determined by the Rdiff_swindow threshold bit 6: scene is inhomogeneous, as determined by the Rdiff_lwindow threshold bit 5: scene is inhomogeneous, as determined by the Rdiff_strat threshold bits 4-0: unused (reserved)

Size: 765450 bytes (0.8 MB) per 45-scanset granule

**Total File Size (plus storage for dimensions and other HDF-EOS overhead):  
6501754 bytes (6.5 MB) per 45-scanset granule = 1560.4 MB per day**

## Special AIRS Types

Limited Engineering Struct: This type is used for engineering data fields for which there are known "yellow" limits

Field Name	Type	Explanation
min	32-bit floating-point	Minimum value field takes on in granule (not valid when num_in = 0)
max	32-bit floating-point	Maximum value field takes on in granule (not valid when num_in = 0)
mean	32-bit floating-point	Mean of in-range values field takes on in granule (not valid when num_in = 0)
dev	32-bit floating-point	Standard Deviation of in-range values field takes on in granule (not valid when num_in = 0)
num_in	32-bit integer	Count of in-range values field takes on in granule
num_lo	32-bit integer	Count of out-of-range low values field takes on in granule
num_hi	32-bit integer	Count of out-of-range high values field takes on in granule
num_bad	32-bit integer	Count of occasions on which field takes on invalid flag value (-9999) in granule
range_min	32-bit floating-point	Minimum in-range value. Any value less than this is counted in num_lo and is not used in the calculation of mean & dev.
range_max	32-bit floating-point	Maximum in-range value. Any value greater than this is counted in num_hi and is not used in the calculation of mean & dev.
missing	8-bit integer	Missing limits flags. Bit 0 (LSB) is 1 when yellow low (range_min) limit is missing; Bit 1 is high when yellow high (range_max) limit is missing; other bits unused, set to 0.
max_track	32-bit integer	GeoTrack index (counting from 1) where max was found
max_xtrack	32-bit integer	GeoXTrack index (counting from 1) where max was found
min_track	32-bit integer	GeoTrack index (counting from 1) where min was found
min_xtrack	32-bit integer	GeoXTrack index (counting from 1) where min was found

Unlimited Engineering Struct: This type is used for engineering data fields for which there are NOT known "yellow" limits

Field Name	Type	Explanation
min	32-bit floating-point	Minimum value field takes on in granule (not valid when num = 0)
max	32-bit floating-point	Maximum value field takes on in granule (not valid when num = 0)
mean	32-bit floating-point	Mean of values field takes on in granule (not valid when num = 0)
dev	32-bit floating-point	Standard Deviation of values field takes on in granule (not valid when num = 0)
num	32-bit integer	Count of occurrences of field in granule (not including those counted in num_bad)
num_bad	32-bit integer	Count of occasions on which field takes on invalid flag value (-9999) in granule
max_track	32-bit integer	GeoTrack index (counting from 1) where max was found
max_xtrack	32-bit integer	GeoXTrack index (counting from 1) where max was found
min_track	32-bit integer	GeoTrack index (counting from 1) where min was found
min_xtrack	32-bit integer	GeoXTrack index (counting from 1) where min was found

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## A-3. L1B Visible/NIR Science Interface Specification

Interface Specification Version 3.0.4.0  
2003-05-19

ESDT ShortName = "AIRVBRAD"

Swath Name = "L1B\_VIS\_Science"

Level = "level1B"

# Footprints = 90

# scanlines per scanset = 3

### Dimensions

These fields define all dimensions that can be used for HDF-EOS swath fields.

The names "GeoTrack" and "GeoXTrack" have a special meaning for this document: "Cross-Track" data fields have a hidden dimension of "GeoXTrack"; "Along-Track" data fields have a hidden dimension of "GeoTrack"; "Full Swath Data Fields" have hidden dimensions of both "GeoTrack" and "GeoXTrack".

Name	Value	Explanation
GeoXTrack	90	Dimension across track for footprint positions. Same as number of footprints per scanline. -- starting at the left and increasing towards the right as you look along the satellite's path
GeoTrack	# of scan lines in swath	Dimension along track for footprint positions. Same as number of scanlines in granule. Parallel to the satellite's path, increasing with time. (Nominally 45 for Level-2, AMSU-A, and AIRS/Vis low-rate engineering; 135 for AIRS/Vis and HSB high-rate quantities)
SubTrack	9	VIS detector elements per AIRS footprint along track (9). Direction is the same as GeoTrack -- parallel to the satellite's path, increasing with time. (opposite order to detector ordering -- detector 0 is last)
SubXTrack	8	VIS samples per AIRS footprint across track (8). Direction is the same as GeoXTrack -- starting at the left and increasing towards the right as you look along the satellite's path
Bulb	3	Number of photometric calibration sources (light bulbs) that can be used as sources for photometric calibration (3)
GainHistory	5	Number of photometric gain calculations to store for use in smoothing of gain (5)
GeoLocationsPerSpot	4	Geolocations for the 4 corner pixels in the order: trailing first scanned; trailing last-scanned; leading first-scanned; leading last-scanned. Each footprint also has a central geolocation associated with the swath geolocation lat/lon/time of the footprint.
Channel	4	Dimension of channel array (Channel 1: ~0.40 micron; Ch 2: ~0.6 micron; Ch 3: ~0.8 micron; Ch 4: broadband)

### Geolocation Fields

These fields appear for every footprint (GeoTrack \* GeoXTrack times) and correspond to footprint center coordinates and "shutter" time.

Name	Explanation
Latitude	Footprint boresight geodetic Latitude in degrees North (-90.0 ... 90.0)
Longitude	Footprint boresight geodetic Longitude in degrees East (-180.0 ... 180.0)
Time	Footprint "shutter" TAI Time: floating-point elapsed seconds since Jan 1, 1993

Size: 291600 bytes (0.3 MB) per 45-scanset granule

### Attributes

These fields appear only once per granule

Name	Type	Extra Dimensions	Explanation
VISDarkAMSUFOVCount	32-bit integer	None	Number of AMSU-A footprints that are uniformly dark in the level-1B VIS/NIR and are thus likely to be uniformly clear
VISBrightAMSUFOVCount	32-bit integer	None	Number of AMSU-A footprints that are uniformly bright in the level-1B VIS/NIR and are thus likely to be uniformly cloudy
processing_level	string of 8-bit characters	None	Zero-terminated character string denoting processing level ("level1B")
instrument	string of 8-bit characters	None	Zero-terminated character string denoting instrument ("VIS")
DayNightFlag	string of 8-bit characters	None	Zero-terminated character string denoting granule as day and/or night: (Always "Day", "Night", or "Both")
AutomaticQAFlag	string of 8-bit	None	Zero-terminated character string denoting granule data quality: (Always "Passed")

	characters		"Failed", or "Suspect")
NumTotalData	32-bit integer	None	Total number of expected scene footprints
NumProcessData	32-bit integer	None	Number of scene footprints which are present and can be processed routinely (state = 0)
NumSpecialData	32-bit integer	None	Number of scene footprints which are present and can be processed only as a special test (state = 1)
NumBadData	32-bit integer	None	Number of scene footprints which are present but cannot be processed (state = 2)
NumMissingData	32-bit integer	None	Number of expected scene footprints which are not present (state = 3)
NumLandSurface	32-bit integer	None	Number of scene footprints for which the surface is more than 90% land
NumOceanSurface	32-bit integer	None	Number of scene footprints for which the surface is less than 10% land
node_type	string of 8-bit characters	None	Zero-terminated character string denoting whether granule is ascending, descending, or pole-crossing: ("Ascending" and "Descending" for entirely ascending or entirely descending granules, or "NorthPole" or "SouthPole" for pole-crossing granules)
start_year	32-bit integer	None	Year in which granule started, UTC (e.g. 1999)
start_month	32-bit integer	None	Month in which granule started, UTC (1 ... 12)
start_day	32-bit integer	None	Day of month in which granule started, UTC (1 ... 31)
start_hour	32-bit integer	None	Hour of day in which granule started, UTC (0 ... 23)
start_minute	32-bit integer	None	Minute of hour in which granule started, UTC (0 ... 59)
start_sec	32-bit floating-point	None	Second of minute in which granule started, UTC (0.0 ... 59.0)
start_orbit	32-bit integer	None	Orbit number of mission in which granule started
end_orbit	32-bit integer	None	Orbit number of mission in which granule ended
orbit_path	32-bit integer	None	Orbit path of start orbit (1 ... 233 as defined by EOS project)
start_orbit_row	32-bit integer	None	Orbit row at start of granule (1 ... 248 as defined by EOS project)
end_orbit_row	32-bit integer	None	Orbit row at end of granule (1 ... 248 as defined by EOS project)
granule_number	32-bit integer	None	Number of granule within day (1 ... 240)
num_scansets	32-bit integer	None	Number of scansets in granule (1 ... 45)
num_scanlines	32-bit integer	None	Number of scanlines in granule (3 * num_scansets)
start_Latitude	64-bit floating-point	None	Geodetic Latitude of spacecraft at start of granule in degrees North (-90.0 ... 90.0)
start_Longitude	64-bit floating-point	None	Geodetic Longitude of spacecraft at start of granule in degrees East (-180.0 ... 180.0)
start_Time	64-bit floating-point	None	TAI Time at start of granule (floating-point elapsed seconds since start of 1993)
end_Latitude	64-bit floating-point	None	Geodetic Latitude of spacecraft at end of granule in degrees North (-90.0 ... 90.0)
end_Longitude	64-bit floating-point	None	Geodetic Longitude of spacecraft at end of granule in degrees East (-180.0 ... 180.0)
end_Time	64-bit floating-point	None	TAI Time at end of granule (floating-point elapsed seconds since start of 1993)
eq_x_longitude	32-bit floating-point	None	Longitude of spacecraft at southward equator crossing nearest granule start in degrees East (-180.0 ... 180.0)
eq_x_tai	64-bit floating-point	None	Time of eq_x_longitude in TAI units (floating-point elapsed seconds since start of 1993)
orbitgeoqa	32-bit unsigned integer	None	Orbit Geolocation QA: bit 0 (LSB): bad input value (last scanline); bit 1: bad input value (first scanline); bit 2: PGS_EPH_GetEphMet() returned PGSEPH_E_NO_SC_EPHEM_FILE; bit 3: PGS_EPH_GetEphMet() returned PGSEPH_E_BAD_ARRAY_SIZE; bit 4: PGS_EPH_GetEphMet() returned PGSTD_E_TIME_FMT_ERROR; bit 5: PGS_EPH_GetEphMet() returned PGSTD_E_TIME_VALUE_ERROR; bit 6: PGS_EPH_GetEphMet() returned PGSTD_E_SC_TAG_UNKNOWN; bit 7: PGS_EPH_GetEphMet() returned PGS_E_TOOLKIT; bit 8: PGS_TD_UTCtoTAI() returned PGSTD_E_NO_LEAP_SECS; bit 9: PGS_TD_UTCtoTAI() returned PGSTD_E_TIME_FMT_ERROR; bit 10: PGS_TD_UTCtoTAI() returned PGSTD_E_TIME_VALUE_ERROR; bit 11: PGS_TD_UTCtoTAI() returned PGS_E_TOOLKIT; bit 12: PGS_CSC_DayNight() returned PGSTD_E_NO_LEAP_SECS; bit 13: PGS_CSC_DayNight() returned PGSCSC_E_INVALID_LIMITTAG; bit 14: PGS_CSC_DayNight() returned PGSCSC_E_BAD_ARRAY_SIZE; bit 15: PGS_CSC_DayNight() returned PGSCSC_W_ERROR_IN_DAYNIGHT; bit 16: PGS_CSC_DayNight() returned PGSCSC_W_BAD_TRANSFORM_VALUE; bit 17: PGS_CSC_DayNight() returned PGSCSC_W_BELOW_HORIZON; bit 18: PGS_CSC_DayNight() returned PGSCSC_W_PREDICTED_UIT1; bit 19: PGS_CSC_DayNight() returned

			PGSTD_E_NO_UT1_VALUE; bit 20: PGS_CSC_DayNight() returned PGSTD_E_BAD_INITIAL_TIME; bit 21: PGS_CSC_DayNight() returned PGSCBP_E_TIME_OUT_OF_RANGE; bit 22: PGS_CSC_DayNight() returned PGSCBP_E_UNABLE_TO_OPEN_FILE; bit 22: PGS_CSC_DayNight() returned PGSMEM_E_NO_MEMORY; bit 24: PGS_CSC_DayNight() returned PGS_E_TOOLKIT; bit 25-31: not used
num_satgeoqa	16-bit integer	None	Number of scans with problems in satgeoqa
num_glintgeoqa	16-bit integer	None	Number of scans with problems in glintgeoqa
num_moongoqa	16-bit integer	None	Number of scans with problems in moongoqa
num_ftptgeoqa	16-bit integer	None	Number of footprints with problems in ftptgeoqa
num_zengeoqa	16-bit integer	None	Number of footprints with problems in zengeoqa
num_demgeoqa	16-bit integer	None	Number of footprints with problems in demgeoqa
num_fpe	16-bit integer	None	Number of floating point errors
LonGranuleCen	16-bit integer	None	Geodetic Longitude of the center of the granule in degrees East (-180 ... 180)
LatGranuleCen	16-bit integer	None	Geodetic Latitude of the center of the granule in degrees North (-90 ... 90)
LocTimeGranuleCen	16-bit integer	None	Local solar time at the center of the granule in minutes past midnight (0 ... 1439)
VegMapFileName	string of 8-bit characters	None	Name of AVHRR input file used as Vegetation Map
limit_scene_counts	Color Counts (see below)	Channel (= 4) * SubTrack (= 9)	Input limit checking on scene data numbers
limit_bb_counts	Color Counts (see below)	Channel (= 4) * SubTrack (= 9)	Input limit checking on data numbers from the blackbody (dark target)
limit_phot_counts	Color Counts (see below)	Channel (= 4) * SubTrack (= 9)	Input limit checking on data numbers from the photometric calibration source (bright target)
limit_vis_det_temp	Color Counts (see below)	None	Input limit checking on Vis sensor array temperature
input_scene_counts	Limited Engineering Struct (see below)	Channel (= 4) * SubTrack (= 9)	Input statistics on scene data numbers
input_bb_counts	Limited Engineering Struct (see below)	Channel (= 4) * SubTrack (= 9)	Input statistics on data numbers from the blackbody (dark target)
input_phot_counts	Limited Engineering Struct (see below)	Channel (= 4) * SubTrack (= 9)	Input statistics on data numbers from the photometric calibration source (bright target)
input_vis_det_temp	Limited Engineering Struct (see below)	None	Input statistics on Vis sensor array temperature
limit_offsets	Color Counts (see below)	Channel (= 4) * SubTrack (= 9)	Output limit checking on offsets
offset_stats	Unlimited Engineering Struct (see below)	Channel (= 4) * SubTrack (= 9)	Statistics on offsets
offset_unc_stats	Unlimited Engineering Struct (see below)	Channel (= 4) * SubTrack (= 9)	Statistics on offset uncertainties
gain_scan	16-bit unsigned integer	None	Scanline number of (first) gain calculation completed in granule. 0 for no gain calculation completed in this granule.
gain_TAI	64-bit floating-point	None	TAI time of (first) gain calculation. (floating-point elapsed seconds since start of 1993) 0.0 for no gain calculation completed in this granule.
gain_TAI_prev	64-bit floating-point	Bulb (= 3) * GainHistory (= 5)	TAI time of previous valid gain calculation on each bulb. (floating-point elapsed seconds since start of 1993)
gain_num	16-bit integer	None	Number of gain calculations in this granule. (Should always be 0 or 1)
gain_bulb	16-bit integer	None	bulb number (1, 2, or 3) of bulb used for (first) gain calculation (including gain calculations started but not completed). 0 for no gain calculation occurred in this granule.
bulb_failed	8-bit integer	None	1 if a bulb failure was detected in this granule, 0 otherwise.
gain	32-bit floating-point	Channel (= 4) * SubTrack (= 9)	Gain: number of radiance units per count. (Same as gain_prev on most recently used bulb when no gain calculation was performed in this granule)

gain_err	32-bit floating-point	Channel (= 4) * SubTrack (= 9)	Error caused by imperfect fit for gain (gain units). (Same as gain_err_prev on most recently used bulb when no gain calculation was performed in this granule)
gain_prev	32-bit floating-point	Bulb (= 3) * GainHistory (= 5) * Channel (= 4) * SubTrack (= 9)	Previous Gain: number of radiance units per count at time of previous gain calculations for each bulb
gain_err_prev	32-bit floating-point	Bulb (= 3) * GainHistory (= 5) * Channel (= 4) * SubTrack (= 9)	gain_err for each gain_prev
gain_start_TAI	64-bit floating-point	None	TAI time when photometric calibration source was turned "on" for a gain calculation that had started but had not finished collecting data at the end of the granule. (floating-point elapsed seconds since start of 1993) 0.0 for no gain calculation left partial at the end of this granule.
gain_num_counts	32-bit integer	Channel (= 4) * SubTrack (= 9)	The number of data points of counts per detector collected in gain_sum_counts and gain_num_counts2 for a gain calculation that had started but had not finished collecting data at the end of the granule. 0.0 for no gain calculation left partial at the end of this granule.
gain_sum_counts	64-bit floating-point	Channel (= 4) * SubTrack (= 9)	The sum of the counts per detector for a gain calculation that had started but had not finished collecting data at the end of the granule. 0.0 for no gain calculation left partial at the end of this granule.
gain_sum_counts2	64-bit floating-point	Channel (= 4) * SubTrack (= 9)	The sum of the squares of counts per detector for a gain calculation that had started but had not finished collecting data at the end of the granule. 0.0 for no gain calculation left partial at the end of this granule.
primary_bulb	16-bit integer	None	Bulb number of photometric calibration source used as primary bulb (1, 2, or 3; 0 for no primary bulb)
secondary_bulb	16-bit integer	None	Bulb number of photometric calibration source used as secondary bulb (1, 2, or 3; 0 for no secondary bulb)
backup_bulb	16-bit integer	None	Bulb number of photometric calibration source used as backup bulb (1, 2, or 3; 0 for no backup bulb)
K21	32-bit floating-point	Channel (= 4) * SubTrack (= 9)	Gain calculated using bulb 2, divided by gain using bulb 1. (Tracks degradation of bulb 1 relative to bulb 2.)
K32	32-bit floating-point	Channel (= 4) * SubTrack (= 9)	Gain calculated using bulb 3, divided by gain using bulb 2. (Tracks degradation of bulb 2 relative to bulb 3.)
K31	32-bit floating-point	Channel (= 4) * SubTrack (= 9)	Gain calculated using bulb 3, divided by gain using bulb 1. (Tracks degradation of bulb 1 relative to bulb 3.)
K_factors_applied	8-bit unsigned integer	Channel (= 4)	Flag if K factors were applied for each channel (1 for yes, 0 for no)
gamma_ground	32-bit floating-point	Channel (= 4) * SubTrack (= 9)	Correction factor applied to gain calculation based on observations of known ground targets
gamma_MODIS	32-bit floating-point	Channel (= 4) * SubTrack (= 9)	Correction factor applied to gain calculation based on co-located MODIS and AIRS observations
rad_stats	Unlimited Engineering Struct (see below)	Channel (= 4) * SubTrack (= 9)	Statistics over the granule of radiances (radiance units)
NeN_stats	Limited Engineering Struct (see below)	Channel (= 4) * SubTrack (= 9)	Statistics over the granule of Noise-equivalent Radiance (NeN)
granules_present	string of 8-bit characters	None	Zero-terminated character string denoting which adjacent granules were available for smoothing ("All" for both previous & next, "Prev" for previous but not next, "Next" for next but not previous, "None" for neither previous nor next)
xtrack_err	32-bit floating-point	Channel (= 4)	cross-track pixel location error estimate per channel (km)
track_err	32-bit floating-point	Channel (= 4)	Along-track pixel location error estimate per channel (km)
align_1_2_nadir	32-bit floating-point	None	Expected error (km) between the pixel locations for the corner locations of near-nadir AIRS footprints (45 & 46) between VIS channels 1 & 2
align_2_3_nadir	32-bit floating-point	None	Expected error (km) between the pixel locations for the corner locations of near-nadir AIRS footprints (45 & 46) between VIS channels 2 & 3
align_2_4_nadir	32-bit floating-point	None	Expected error (km) between the pixel locations for the corner locations of near-nadir AIRS footprints (45 & 46) between VIS channels 2 & 4
align_1_2_maxang	32-bit floating-point	None	Expected error (km) between the pixel locations for the corner locations of near-limb AIRS footprints (1 & 90) between VIS channels 1 & 2
align_2_3_maxang	32-bit floating-point	None	Expected error (km) between the pixel locations for the corner locations of near-limb AIRS footprints (1 & 90) between VIS channels 2 & 3

align_2_4_maxang	32-bit floating-point	None	Expected error (km) between the pixel locations for the corner locations of near-limb AIRS footprints (1 & 90) between VIS channels 2 & 4
align_vis_airs	32-bit floating-point	None	Expected error (km) between the pixel locations for the corner locations of near-nadir AIRS footprints (45 & 46) between the AIRS center and all VIS channels

Size: 32792 bytes (0.0 MB) per granule

## Along-Track Data Fields

These fields appear once per scanline (GeoTrack times)

Name	Type	Extra Dimensions	Explanation
offset	32-bit floating-point	Channel (= 4) * SubTrack (= 9)	Offset: number of counts expected for no radiance at time nadirTAI
offset_err	32-bit floating-point	Channel (= 4) * SubTrack (= 9)	Error caused by imperfect fit for offset (radiance units)
NeN	32-bit floating-point	Channel (= 4) * SubTrack (= 9)	Noise-equivalent Radiance (radiance units)
satheight	32-bit floating-point	None	Satellite altitude at nadirTAI in km above reference ellipsoid (e.g. 725.2)
satroll	32-bit floating-point	None	Satellite attitude roll angle at nadirTAI (-180.0 ... 180.0 angle about the +x (roll) ORB axis, +x axis is positively oriented in the direction of orbital flight completing an orthogonal triad with y and z.)
satpitch	32-bit floating-point	None	Satellite attitude pitch angle at nadirTAI (-180.0 ... 180.0 angle about +y (pitch) ORB axis. +y axis is oriented normal to the orbit plane with the positive sense opposite to that of the orbit's angular momentum vector H.)
satyaw	32-bit floating-point	None	Satellite attitude yaw angle at nadirTAI (-180.0 ... 180.0 angle about +z (yaw) axis. +z axis is positively oriented earthward parallel to the satellite radius vector R from the spacecraft center of mass to the center of the Earth.)
satgeoqa	32-bit unsigned integer	None	Satellite Geolocation QA flags: bit 0 (LSB): bad input value; bit 1: PGS_TD_TAtoUTC() returned PGSTD_E_NO_LEAP_SECS; bit 2: PGS_TD_TAtoUTC() returned PGS_E_TOOLKIT; bit 3: PGS_EPH_EphemAttit() returned PGSEPH_W_BAD_EPHEM_VALUE; bit 4: PGS_EPH_EphemAttit() returned PGSEPH_E_BAD_EPHEM_FILE_HDR; bit 5: PGS_EPH_EphemAttit() returned PGSEPH_E_NO_SC_EPHEM_FILE; bit 6: PGS_EPH_EphemAttit() returned PGSEPH_E_NO_DATA_REQUESTED; bit 7: PGS_EPH_EphemAttit() returned PGSTD_E_SC_TAG_UNKNOWN; bit 8: PGS_EPH_EphemAttit() returned PGSEPH_E_BAD_ARRAY_SIZE; bit 9: PGS_EPH_EphemAttit() returned PGSTD_E_TIME_FMT_ERROR; bit 10: PGS_EPH_EphemAttit() returned PGSTD_E_TIME_VALUE_ERROR; bit 11: PGS_EPH_EphemAttit() returned PGSTD_E_NO_LEAP_SECS; bit 12: PGS_EPH_EphemAttit() returned PGS_E_TOOLKIT; bit 13: PGS_CSC_ECtoECR() returned PGSCSC_W_BAD_TRANSFORM_VALUE; bit 14: PGS_CSC_ECtoECR() returned PGSCSC_E_BAD_ARRAY_SIZE; bit 15: PGS_CSC_ECtoECR() returned PGSTD_E_NO_LEAP_SECS; bit 16: PGS_CSC_ECtoECR() returned PGSTD_E_TIME_FMT_ERROR; bit 17: PGS_CSC_ECtoECR() returned PGSTD_E_TIME_VALUE_ERROR; bit 18: unused (set to zero); bit 19: PGS_CSC_ECtoECR() returned PGSTD_E_NO_UT1_VALUE; bit 20: PGS_CSC_ECtoECR() returned PGS_E_TOOLKIT; bit 21: PGS_CSC_ECRtoGEO() returned PGSCSC_W_TOO_MANY_ITERS; bit 22: PGS_CSC_ECRtoGEO() returned PGSCSC_W_INVALID_ALTITUDE; bit 23: PGS_CSC_ECRtoGEO() returned PGSCSC_W_SPHERE_BODY; bit 24: PGS_CSC_ECRtoGEO() returned PGSCSC_W_LARGE_FLATTENING; bit 25: PGS_CSC_ECRtoGEO() returned PGSCSC_W_DEFAULT_EARTH_MODEL; bit 26: PGS_CSC_ECRtoGEO() returned PGSCSC_E_BAD_EARTH_MODEL; bit 27: PGS_CSC_ECRtoGEO() returned PGS_E_TOOLKIT; bit 28-31: not used
glintgeoqa	16-bit unsigned integer	None	Glint Geolocation QA flags: bit 0 (LSB): bad input value; bit 1: glint location in Earth's shadow; bit 2: glint calculation not converging; bit 3: glint location sun vs. satellite zenith mismatch; bit 4: glint location sun vs. satellite azimuth mismatch; bit 5: bad glint location; bit 6: PGS_CSC_ZenithAzimuth() returned any 'W' class return code; bit 7: PGS_CSC_ZenithAzimuth() returned any 'E' class return code; bit 8: PGS_CBP_Earth_CB_Vector() returned any 'W' class return code; bit 9: PGS_CBP_Earth_CB_Vector() returned any 'E' class return code; bit 10: PGS_CSC_ECtoECR() returned any 'W' class return code except PGSCSC_W_PREDICTED_UT1 (for Glint); bit 11: PGS_CSC_ECtoECR() returned any 'E' class return code (for Glint); bit 12: PGS_CSC_ECRtoGEO() returned any 'W' class return code (for Glint); bit 13: PGS_CSC_ECRtoGEO() returned any 'E' class return code (for Glint); bit 14: PGS_CSC_ECtoECR() returned any 'W' class return code except PGSCSC_W_PREDICTED_UT1; bit 15: PGS_CSC_ECtoECR() returned any 'E' class return code
moongeoa	16-bit unsigned integer	None	Moon Geolocation QA flags: bit 0 (LSB): bad input value; bit 1: PGS_TD_TAtoUTC() returned PGSTD_E_NO_LEAP_SECS; bit 2: PGS_TD_TAtoUTC() returned PGS_E_TOOLKIT; bit 3: PGS_CBP_Sat_CB_Vector() returned PGSCBP_W_BELOW_SURFACE; bit 4: PGS_CBP_Sat_CB_Vector() returned PGSCBP_W_BAD_CB_VECTOR; bit 5: PGS_CBP_Sat_CB_Vector() returned PGSCBP_E_BAD_ARRAY_SIZE; bit 6: PGS_CBP_Sat_CB_Vector() returned PGSCBP_E_INVALID_CB_ID; bit 7: PGS_CBP_Sat_CB_Vector() returned PGSMEM_E_NO_MEMORY; bit 8: PGS_CBP_Sat_CB_Vector() returned PGSCBP_E_UNABLE_TO_OPEN_FILE; bit 9: PGS_CBP_Sat_CB_Vector() returned PGSTD_F_BAD_INITIAL_TIME; bit 10:

			PGS_CBP_Sat_CB_Vector() returned PGSCBP_E_TIME_OUT_OF_RANGE; bit 11: PGS_CBP_Sat_CB_Vector() returned PGSTD_E_SC_TAG_UNKNOWN; bit 12: PGS_CBP_Sat_CB_Vector() returned PGSEPH_E_BAD_EPHEM_FILE_HDR; bit 13: PGS_CBP_Sat_CB_Vector() returned PGSEPH_E_NO_SC_EPHEM_FILE; bit 14: PGS_CBP_Sat_CB_Vector() returned PGS_E_TOOLKIT; bit 15: not used
nadirTAI	64-bit floating-point	None	TAI time at which instrument is nominally looking directly down. (between footprints 15 & 16 for AMSU or between footprints 45 & 46 for AIRS/Vis & HSB) (floating-point elapsed seconds since start of 1993)
sat_lat	64-bit floating-point	None	Satellite geodetic latitude in degrees North (-90.0 ... 90.0)
sat_lon	64-bit floating-point	None	Satellite geodetic longitude in degrees East (-180.0 ... 180.0)
scan_node_type	8-bit integer	None	'A' for ascending, 'D' for descending, 'N' for North-Polar, 'S' for South-Polar
glintlat	32-bit floating-point	None	Solar glint geodetic latitude in degrees North at nadirTAI (-90.0 ... 90.0)
glintlon	32-bit floating-point	None	Solar glint geodetic longitude in degrees East at nadirTAI (-180.0 ... 180.0)
VisnSrArrTemp	32-bit floating-point	None	Vis/NIR Sensor Array Temperature (Celcius)
ScHeadTemp1	32-bit floating-point	None	Scanner Head Housing Temperature 1 (active A or B) (Celcius)
OpMode	16-bit unsigned integer	None	Instrument Operations Mode. See AIRS Command Handbook, section 6.4 for a definition of each bit. bits 0 (LSB)-2 cal phase; bits 3-6 Cal Func; bit 7 quicklook (expedited) flag; bits 8-11 submode bits 12-14 Mode (0=standby, 1=ready, 2=operate, 3=checkout, 4=decontaminate, 5=off, 6=survival); bit 16 transition flag

Size: 67365 bytes (0.1 MB) per 45-scanset granule

## Full Swath Data Fields

These fields appear for every footprint of every scanline in the granule (GeoTrack \* GeoXTrack times)

Name	Type	Extra Dimensions	Explanation
radiances	32-bit floating-point	Channel (= 4) * SubTrack (= 9) * SubXTrack (= 8)	Radiances for each channel in Watts/m**2/micron/steradian
PrelimCldQA	8-bit integer	None	Cloud QA index (0-good or 1-bad) -1 for not calculated
PrelimCldPrcVis	8-bit integer	None	Cloud Percent (0...100) -1 for not calculated
PrelimCldPrcVisErr	8-bit integer	None	Cloud Fraction Error (0...100) -1 for not calculated
PrelimClrPrcVis	8-bit integer	None	Clear Fraction (0...100) -1 for not calculated
PrelimClrPrcVisErr	8-bit integer	None	Clear Fraction Error (0...100) -1 for not calculated
PrelimCldMapVis	8-bit integer	SubTrack (= 9) * SubXTrack (= 8)	Cloud Map (0-clear, 1-cloudy) -1 for not calculated
PrelimNDVI	32-bit floating-point	SubTrack (= 9) * SubXTrack (= 8)	Vegetation Index (-1.0 to 1.0) -999.0 for not calculated
bright_index	16-bit integer	None	Brightness index (1...5, 5 is brightest. -1 for not calculated)
inhomo_index	16-bit integer	None	Inhomogeneity index (0...64, 1st digit NDVI-Dev, 2nd digit Ch1-Dev, -9999 for not calculated)
scanang	32-bit floating-point	None	Scanning angle of AIRS instrument with respect to the AIRS Instrument for this footprint (-180.0 ... 180.0, negative at start of scan, 0 at nadir)
ftptgeoqa	32-bit unsigned integer	None	Footprint Geolocation QA flags: bit 0 (LSB): bad input value; bit 1: PGS_TD_TAItoUTC() returned PGSTD_E_NO_LEAP_SECS; bit 2: PGS_TD_TAItoUTC() returned PGS_E_TOOLKIT; bit 3: PGS_CSC_GetFOV_Pixel() returned PGSCSC_W_MISS_EARTH; bit 4: PGS_CSC_GetFOV_Pixel() returned PGSTD_E_SC_TAG_UNKNOWN; bit 5: PGS_CSC_GetFOV_Pixel() returned PGSCSC_W_ZERO_PIXEL_VECTOR; bit 6: PGS_CSC_GetFOV_Pixel() returned PGSCSC_W_BAD_EPH_FOR_PIXEL; bit 7: PGS_CSC_GetFOV_Pixel() returned PGSCSC_W_INSTRUMENT_OFF_BOARD; bit 8: PGS_CSC_GetFOV_Pixel() returned PGSCSC_W_BAD_ACCURACY_FLAG; bit 9: PGS_CSC_GetFOV_Pixel() returned PGSCSC_E_BAD_ARRAY_SIZE; bit 10: PGS_CSC_GetFOV_Pixel() returned PGSCSC_W_DEFAULT_EARTH_MODEL; bit 11: PGS_CSC_GetFOV_Pixel() returned PGSCSC_W_DATA_FILE_MISSING; bit 12: PGS_CSC_GetFOV_Pixel() returned PGSCSC_E_NEG_OR_ZERO_RAD; bit 13: PGS_CSC_GetFOV_Pixel() returned PGSMEM_E_NO_MEMORY; bit 14: PGS_CSC_GetFOV_Pixel() returned PGSTD_E_NO_LEAP_SECS; bit 15: PGS_CSC_GetFOV_Pixel() returned PGSTD_E_TIME_FMT_ERROR; bit 16: PGS_CSC_GetFOV_Pixel() returned PGSTD_E_TIME_VALUE_ERROR; bit 17: PGS_CSC_GetFOV_Pixel() returned PGSCSC_W_PREDICTED_UT1; bit 18: PGS_CSC_GetFOV_Pixel() returned PGSTD_E_NO_UT1_VALUE; bit 19: PGS_CSC_GetFOV_Pixel() returned PGS_E_TOOLKIT; bit 20: PGS_CSC_GetFOV_Pixel() returned PGSEPH_E_BAD_EPHEM_FILE_HDR; bit 21: PGS_CSC_GetFOV_Pixel() returned PGSEPH_E_NO_SC_EPHEM_FILE; bit 22-31: not used

zengeoqa	16-bit unsigned integer	None	Satellite zenith Geolocation QA flags: bit 0 (LSB): (Spacecraft) bad input value; bit 1: PGS_CSC_ZenithAzimuth(S/C) returned PGSCSC_W_BELOW_HORIZON; bit 2: PGS_CSC_ZenithAzimuth(S/C) returned PGSCSC_W_UNDEFINED_AZIMUTH; bit 3: PGS_CSC_ZenithAzimuth(S/C) returned PGSCSC_W_NO_REFRACTION; bit 4: PGS_CSC_ZenithAzimuth(S/C) returned PGSCSC_E_INVALID_VECTAG; bit 5: PGS_CSC_ZenithAzimuth(S/C) returned PGSCSC_E_LOOK_PT_ALTIT_RANGE; bit 6: PGS_CSC_ZenithAzimuth(S/C) returned PGSCSC_E_ZERO_INPUT_VECTOR; bit 7: PGS_CSC_ZenithAzimuth(S/C) returned PGS_E_TOOLKIT; bit 8: (Sun) bad input value; bit 9: (suppressed) PGS_CSC_ZenithAzimuth(Sun) returned PGSCSC_W_BELOW_HORIZON (This is not an error condition - the sun is below the horizon at night); bit 10: PGS_CSC_ZenithAzimuth(Sun) returned PGSCSC_W_UNDEFINED_AZIMUTH; bit 11: PGS_CSC_ZenithAzimuth(Sun) returned PGSCSC_W_NO_REFRACTION; bit 12: PGS_CSC_ZenithAzimuth(Sun) returned PGSCSC_E_INVALID_VECTAG; bit 13: PGS_CSC_ZenithAzimuth(Sun) returned PGSCSC_E_LOOK_PT_ALTIT_RANGE; bit 14: PGS_CSC_ZenithAzimuth(Sun) returned PGSCSC_E_ZERO_INPUT_VECTOR; bit 15: PGS_CSC_ZenithAzimuth(Sun) returned PGS_E_TOOLKIT
demgeoqa	16-bit unsigned integer	None	Digital Elevation Model (DEM) Geolocation QA flags: bit 0 (LSB): bad input value; bit 1: Could not allocate memory; bit 2: Too close to North or South pole. Excluded; bit 3: Layer resolution incompatibility. Excluded; bit 4: Any DEM Routine (elev) returned PGSDEM_E_IMPROPER_TAG; bit 5: Any DEM Routine (elev) returned PGSDEM_E_CANNOT_ACCESS_DATA; bit 6: Any DEM Routine (land/water) returned PGSDEM_E_IMPROPER_TAG; bit 7: Any DEM Routine (land/water) returned PGSDEM_E_CANNOT_ACCESS_DATA; bit 8: Reserved for future layers; bit 9: Reserved for future layers; bit 10: PGS_DEM_GetRegion(elev) returned PGSDEM_M_FILLVALUE_INCLUDED; bit 11: PGS_DEM_GetRegion(land/water) returned PGSDEM_M_FILLVALUE_INCLUDED; bit 12: Reserved for future layers; bit 13: PGS_DEM_GetRegion(all) returned PGSDEM_M_MULTIPLE_RESOLUTIONS; bit 14: PGS_CSC_GetFOV_Pixel() returned any 'W' class return code except PGSCSC_W_PREDICTED_UT1; bit 15: PGS_CSC_GetFOV_Pixel() returned any 'E' class return code
satzen	32-bit floating-point	None	Spacecraft zenith angle (0.0 ... 180.0) degrees from zenith (measured relative to the geodetic vertical on the reference (WGS84) spheroid and including corrections outlined in EOS SDP toolkit for normal accuracy.)
satazi	32-bit floating-point	None	Spacecraft azimuth angle (-180.0 ... 180.0) degrees E of N GEO
solzen	32-bit floating-point	None	Solar zenith angle (0.0 ... 180.0) degrees from zenith (measured relative to the geodetic vertical on the reference (WGS84) spheroid and including corrections outlined in EOS SDP toolkit for normal accuracy.)
solazi	32-bit floating-point	None	Solar azimuth angle (-180.0 ... 180.0) degrees E of N GEO
sun_glint_distance	16-bit integer	None	Distance (km) from footprint center to location of the sun glint (-9999 for unknown, 30000 for no glint visible because spacecraft is in Earth's shadow)
topog	32-bit floating-point	None	Mean topography in meters above reference ellipsoid
topog_err	32-bit floating-point	None	Error estimate for topog
landFrac	32-bit floating-point	None	Fraction of spot that is land (0.0 ... 1.0)
landFrac_err	32-bit floating-point	None	Error estimate for landFrac
state	32-bit integer	None	Data state: 0:Process, 1:Special, 2:Erroneous, 3:Missing
cornerlats	32-bit floating-point	GeoLocationsPerSpot (= 4) * Channel (= 4)	Geodetic Latitudes at the centers of the pixels at the corners of the IR footprint by channel in degrees North (-90.0 ... 90.0)
cornerlons	32-bit floating-point	GeoLocationsPerSpot (= 4) * Channel (= 4)	Geodetic Longitudes at the centers of the pixels at the corners of the IR footprint by channel in degrees East (-180.0 ... 180.0)

Size: 20642850 bytes (20.6 MB) per 45-scanset granule

**Total File Size (plus storage for dimensions and other HDF-EOS overhead):  
21034607 bytes (21.0 MB) per 45-scanset granule = 5048.3 MB per day**

## Special AIRS Types

Limited Engineering Struct: This type is used for engineering data fields for which there are known "yellow" limits

Field Name	Type	Explanation
min	32-bit floating-point	Minimum value field takes on in granule (not valid when num_in = 0)
max	32-bit floating-point	Maximum value field takes on in granule (not valid when num_in = 0)
mean	32-bit floating-point	Mean of in-range values field takes on in granule (not valid when num_in = 0)
dev	32-bit floating-point	Standard Deviation of in-range values field takes on in granule (not valid when num_in = 0)
num_in	32-bit integer	Count of in-range values field takes on in granule
num_lo	32-bit integer	Count of out-of-range low values field takes on in granule
num_hi	32-bit integer	Count of out-of-range high values field takes on in granule
num_bad	32-bit integer	Count of occasions on which field takes on invalid flag value (-9999) in granule
range_min	32-bit floating-point	Minimum in-range value. Any value less than this is counted in num_lo and is not used in the calculation of mean & dev.
range_max	32-bit floating-point	Maximum in-range value. Any value greater than this is counted in num_hi and is not used in the calculation of mean & dev.
missing	8-bit integer	Missing limits flags. Bit 0 (LSB) is 1 when yellow low (range_min) limit is missing; Bit 1 is high when yellow high (range_max) limit is missing; other bits unused, set to 0.
max_track	32-bit integer	GeoTrack index (counting from 1) where max was found
max_xtrack	32-bit integer	GeoXTrack index (counting from 1) where max was found
min_track	32-bit integer	GeoTrack index (counting from 1) where min was found
min_xtrack	32-bit integer	GeoXTrack index (counting from 1) where min was found

Unlimited Engineering Struct: This type is used for engineering data fields for which there are NOT known "yellow" limits

Field Name	Type	Explanation
min	32-bit floating-point	Minimum value field takes on in granule (not valid when num = 0)
max	32-bit floating-point	Maximum value field takes on in granule (not valid when num = 0)
mean	32-bit floating-point	Mean of values field takes on in granule (not valid when num = 0)
dev	32-bit floating-point	Standard Deviation of values field takes on in granule (not valid when num = 0)
num	32-bit integer	Count of occurrences of field in granule (not including those counted in num_bad)
num_bad	32-bit integer	Count of occasions on which field takes on invalid flag value (-9999) in granule
max_track	32-bit integer	GeoTrack index (counting from 1) where max was found
max_xtrack	32-bit integer	GeoXTrack index (counting from 1) where max was found
min_track	32-bit integer	GeoTrack index (counting from 1) where min was found
min_xtrack	32-bit integer	GeoXTrack index (counting from 1) where min was found

Color Counts: This type tracks counts of values received during an interval by how they compare to corresponding "red" and "yellow" limits

Field Name	Type	Explanation
red_lo_limit	32-bit floating-point	Value of the low "red" limit.
red_lo_cnt	32-bit integer	Count of values less than the low "red" limit. This is an "Alarm" condition.
to_red_lo	32-bit integer	Count of occasions on which the "color" of this field changed from some other value to "red_low".
yellow_lo_limit	32-bit floating-point	Value of the low "yellow" limit.
yellow_lo_cnt	32-bit integer	Count of values greater than the low "red" limit but less than the low "yellow" limit. This is a "Warning" condition.
to_yellow_lo	32-bit integer	Count of occasions on which the "color" of this field changed from some other value to "yellow_low".
green_cnt	32-bit integer	Count of values greater than the low "yellow" limit but less than the high "yellow" limit.
to_green	32-bit integer	Count of occasions on which the "color" of this field changed from some other value to "green".
yellow_hi_limit	32-bit floating-point	Value of the high "yellow" limit.
yellow_hi_cnt	32-bit integer	Count of values greater than the high "yellow" limit but less than the high "red" limit. This is a "Warning"



		condition.
to_yellow_hi	32-bit integer	Count of occasions on which the "color" of this field changed from some other value to "yellow_high".
red_hi_limit	32-bit floating-point	Value of the high "red" limit.
red_hi_cnt	32-bit integer	Count of values greater than the high "red" limit. This is an "Alarm" condition.
to_red_hi	32-bit integer	Count of occasions on which the "color" of this field changed from some other value to "red_high".
missing	8-bit integer	Missing limits flags. Bit 0 (LSB) is 1 when yellow low limit (yellow_lo_limit) is missing; Bit 1 is high when yellow high limit is missing; Bit 2 is 1 when red low limit is missing; Bit 3 is 1 when red high limit is missing; Other bits unused set to 0.

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## A-4. L1B Visible/NIR QA Interface Specification

Interface Specification Version 3.0.4.0  
2003-05-19

ESDT ShortName = "AIRVBQAP"

Swath Name = "L1B\_VIS\_QA"

Level = "level1B"

# Footprints = 90

# scanlines per scanset = 3

### Dimensions

These fields define all dimensions that can be used for HDF-EOS swath fields.

The names "GeoTrack" and "GeoXTrack" have a special meaning for this document: "Cross-Track" data fields have a hidden dimension of "GeoXTrack"; "Along-Track" data fields have a hidden dimension of "GeoTrack"; "Full Swath Data Fields" have hidden dimensions of both "GeoTrack" and "GeoXTrack".

Name	Value	Explanation
GeoXTrack	90	Dimension across track for footprint positions. Same as number of footprints per scanline. -- starting at the left and increasing towards the right as you look along the satellite's path
GeoTrack	# of scan lines in swath	Dimension along track for footprint positions. Same as number of scanlines in granule. Parallel to the satellite's path, increasing with time. (Nominally 45 for Level-2, AMSU-A, and AIRS/Vis low-rate engineering; 135 for AIRS/Vis and HSB high-rate quantities)
SubTrack	9	VIS detector elements per AIRS footprint along track (9). Direction is the same as GeoTrack -- parallel to the satellite's path, increasing with time. (opposite order to detector ordering -- detector 0 is last)
SubXTrack	8	VIS samples per AIRS footprint across track (8). Direction is the same as GeoXTrack -- starting at the left and increasing towards the right as you look along the satellite's path
Bulb	3	Number of photometric calibration sources (light bulbs) that can be used as sources for photometric calibration (3)
GainHistory	5	Number of photometric gain calculations to store for use in smoothing of gain (5)
GeoLocationsPerSpot	4	Geolocations for the 4 corner pixels in the order: trailing first scanned; trailing last-scanned; leading first-scanned; leading last-scanned. Each footprint also has a central geolocation associated with the swath geolocation lat/lon/time of the footprint.
Channel	4	Dimension of channel array (Channel 1: ~0.40 micron; Ch 2: ~0.6 micron; Ch 3: ~0.8 micron; Ch 4: broadband)

### Geolocation Fields

These fields appear for every footprint (GeoTrack \* GeoXTrack times) and correspond to footprint center coordinates and "shutter" time.

Name	Explanation
Latitude	Footprint boresight geodetic Latitude in degrees North (-90.0 ... 90.0)
Longitude	Footprint boresight geodetic Longitude in degrees East (-180.0 ... 180.0)
Time	Footprint "shutter" TAI Time: floating-point elapsed seconds since Jan 1, 1993

Size: 291600 bytes (0.3 MB) per 45-scanset granule

### Attributes

These fields appear only once per granule

Name	Type	Extra Dimensions	Explanation
processing_level	string of 8-bit characters	None	Zero-terminated character string denoting processing level ("level1B")
instrument	string of 8-bit characters	None	Zero-terminated character string denoting instrument ("VIS")
DayNightFlag	string of 8-bit characters	None	Zero-terminated character string denoting granule as day and/or night: (Always "Day", "Night", or "Both")
AutomaticQAFlag	string of 8-bit characters	None	Zero-terminated character string denoting granule data quality: (Always "Passed", "Failed", or "Suspect")
NumTotalData	32-bit integer	None	Total number of expected scene footprints
NumProcessData	32-bit integer	None	Number of scene footprints which are present and can be processed routinely (state = 0)

NumSpecialData	32-bit integer	None	Number of scene footprints which are present and can be processed only as a special test (state = 1)
NumBadData	32-bit integer	None	Number of scene footprints which are present but cannot be processed (state = 2)
NumMissingData	32-bit integer	None	Number of expected scene footprints which are not present (state = 3)
NumLandSurface	32-bit integer	None	Number of scene footprints for which the surface is more than 90% land
NumOceanSurface	32-bit integer	None	Number of scene footprints for which the surface is less than 10% land
node_type	string of 8-bit characters	None	Zero-terminated character string denoting whether granule is ascending, descending, or pole-crossing: ("Ascending" and "Descending" for entirely ascending or entirely descending granules, or "NorthPole" or "SouthPole" for pole-crossing granules)
start_year	32-bit integer	None	Year in which granule started, UTC (e.g. 1999)
start_month	32-bit integer	None	Month in which granule started, UTC (1 ... 12)
start_day	32-bit integer	None	Day of month in which granule started, UTC (1 ... 31)
start_hour	32-bit integer	None	Hour of day in which granule started, UTC (0 ... 23)
start_minute	32-bit integer	None	Minute of hour in which granule started, UTC (0 ... 59)
start_sec	32-bit floating-point	None	Second of minute in which granule started, UTC (0.0 ... 59.0)
start_orbit	32-bit integer	None	Orbit number of mission in which granule started
end_orbit	32-bit integer	None	Orbit number of mission in which granule ended
orbit_path	32-bit integer	None	Orbit path of start orbit (1 ... 233 as defined by EOS project)
start_orbit_row	32-bit integer	None	Orbit row at start of granule (1 ... 248 as defined by EOS project)
end_orbit_row	32-bit integer	None	Orbit row at end of granule (1 ... 248 as defined by EOS project)
granule_number	32-bit integer	None	Number of granule within day (1 ... 240)
num_scansets	32-bit integer	None	Number of scansets in granule (1 ... 45)
num_scanlines	32-bit integer	None	Number of scanlines in granule (3 * num_scansets)
start_Latitude	64-bit floating-point	None	Geodetic Latitude of spacecraft at start of granule in degrees North (-90.0 ... 90.0)
start_Longitude	64-bit floating-point	None	Geodetic Longitude of spacecraft at start of granule in degrees East (-180.0 ... 180.0)
start_Time	64-bit floating-point	None	TAI Time at start of granule (floating-point elapsed seconds since start of 1993)
end_Latitude	64-bit floating-point	None	Geodetic Latitude of spacecraft at end of granule in degrees North (-90.0 ... 90.0)
end_Longitude	64-bit floating-point	None	Geodetic Longitude of spacecraft at end of granule in degrees East (-180.0 ... 180.0)
end_Time	64-bit floating-point	None	TAI Time at end of granule (floating-point elapsed seconds since start of 1993)
eq_x_longitude	32-bit floating-point	None	Longitude of spacecraft at southward equator crossing nearest granule start in degrees East (-180.0 ... 180.0)
eq_x_tai	64-bit floating-point	None	Time of eq_x_longitude in TAI units (floating-point elapsed seconds since start of 1993)
orbitgeoqa	32-bit unsigned integer	None	Orbit Geolocation QA: bit 0 (LSB): bad input value (last scanline); bit 1: bad input value (first scanline); bit 2: PGS_EPH_GetEphMet() returned PGSEPH_E_NO_SC_EPHEM_FILE; bit 3: PGS_EPH_GetEphMet() returned PGSEPH_E_BAD_ARRAY_SIZE; bit 4: PGS_EPH_GetEphMet() returned PGSTD_E_TIME_FMT_ERROR; bit 5: PGS_EPH_GetEphMet() returned PGSTD_E_TIME_VALUE_ERROR; bit 6: PGS_EPH_GetEphMet() returned PGSTD_E_SC_TAG_UNKNOWN; bit 7: PGS_EPH_GetEphMet() returned PGS_E_TOOLKIT; bit 8: PGS_TD_UTCtoTAI() returned PGSTD_E_NO_LEAP_SECS; bit 9: PGS_TD_UTCtoTAI() returned PGSTD_E_TIME_FMT_ERROR; bit 10: PGS_TD_UTCtoTAI() returned PGSTD_E_TIME_VALUE_ERROR; bit 11: PGS_TD_UTCtoTAI() returned PGS_E_TOOLKIT; bit 12: PGS_CSC_DayNight() returned PGSTD_E_NO_LEAP_SECS; bit 13: PGS_CSC_DayNight() returned PGSCSC_E_INVALID_LIMITTAG; bit 14: PGS_CSC_DayNight() returned PGSCSC_E_BAD_ARRAY_SIZE; bit 15: PGS_CSC_DayNight() returned PGSCSC_W_ERROR_IN_DAYNIGHT; bit 16: PGS_CSC_DayNight() returned PGSCSC_W_BAD_TRANSFORM_VALUE; bit 17: PGS_CSC_DayNight() returned PGSCSC_W_BELOW_HORIZON; bit 18: PGS_CSC_DayNight() returned PGSCSC_W_PREDICTED_UT1; bit 19: PGS_CSC_DayNight() returned PGSTD_E_NO_UT1_VALUE; bit 20: PGS_CSC_DayNight() returned PGSTD_E_BAD_INITIAL_TIME; bit 21: PGS_CSC_DayNight() returned PGSCBP_E_TIME_OUT_OF_RANGE; bit 22: PGS_CSC_DayNight() returned PGSCBP_E_UNABLE_TO_OPEN_FILE; bit 23: PGS_CSC_DayNight() returned PGSMEM_E_NO_MEMORY; bit 24: PGS_CSC_DayNight() returned PGS_E_TOOLKIT; bit 25-31: not used
num_satgeoqa	16-bit integer	None	Number of scans with problems in satgeoqa

num_glintgeoqa	16-bit integer	None	Number of scans with problems in glintgeoqa
num_moongeoqa	16-bit integer	None	Number of scans with problems in moongeoqa
num_ftptgeoqa	16-bit integer	None	Number of footprints with problems in ftptgeoqa
num_zengeoqa	16-bit integer	None	Number of footprints with problems in zengeoqa
num_demgeoqa	16-bit integer	None	Number of footprints with problems in demgeoqa
num_fpe	16-bit integer	None	Number of floating point errors
LonGranuleCen	16-bit integer	None	Geodetic Longitude of the center of the granule in degrees East (-180 ... 180)
LatGranuleCen	16-bit integer	None	Geodetic Latitude of the center of the granule in degrees North (-90 ... 90)
LocTimeGranuleCen	16-bit integer	None	Local solar time at the center of the granule in minutes past midnight (0 ... 1439)
VegMapFileName	string of 8-bit characters	None	Name of AVHRR input file used as Vegetation Map
limit_scene_counts	Color Counts (see below)	Channel (= 4) * SubTrack (= 9)	Input limit checking on scene data numbers
limit_bb_counts	Color Counts (see below)	Channel (= 4) * SubTrack (= 9)	Input limit checking on data numbers from the blackbody (dark target)
limit_phot_counts	Color Counts (see below)	Channel (= 4) * SubTrack (= 9)	Input limit checking on data numbers from the photometric calibration source (bright target)
limit_vis_det_temp	Color Counts (see below)	None	Input limit checking on Vis sensor array temperature
input_scene_counts	Limited Engineering Struct (see below)	Channel (= 4) * SubTrack (= 9)	Input statistics on scene data numbers
input_bb_counts	Limited Engineering Struct (see below)	Channel (= 4) * SubTrack (= 9)	Input statistics on data numbers from the blackbody (dark target)
input_phot_counts	Limited Engineering Struct (see below)	Channel (= 4) * SubTrack (= 9)	Input statistics on data numbers from the photometric calibration source (bright target)
input_vis_det_temp	Limited Engineering Struct (see below)	None	Input statistics on Vis sensor array temperature
limit_offsets	Color Counts (see below)	Channel (= 4) * SubTrack (= 9)	Output limit checking on offsets
offset_stats	Unlimited Engineering Struct (see below)	Channel (= 4) * SubTrack (= 9)	Statistics on offsets
offset_unc_stats	Unlimited Engineering Struct (see below)	Channel (= 4) * SubTrack (= 9)	Statistics on offset uncertainties
gain_scan	16-bit unsigned integer	None	Scanline number of (first) gain calculation completed in granule. 0 for no gain calculation completed in this granule.
gain_TAI	64-bit floating-point	None	TAI time of (first) gain calculation. (floating-point elapsed seconds since start of 1993) 0.0 for no gain calculation completed in this granule.
gain_TAI_prev	64-bit floating-point	Bulb (= 3) * GainHistory (= 5)	TAI time of previous valid gain calculation on each bulb. (floating-point elapsed seconds since start of 1993)
gain_num	16-bit integer	None	Number of gain calculations in this granule. (Should always be 0 or 1)
gain_bulb	16-bit integer	None	bulb number (1, 2, or 3) of bulb used for (first) gain calculation (including gain calculations started but not completed). 0 for no gain calculation occurred in this granule.
bulb_failed	8-bit integer	None	1 if a bulb failure was detected in this granule, 0 otherwise.
gain	32-bit floating-point	Channel (= 4) * SubTrack (= 9)	Gain: number of radiance units per count. (Same as gain_prev on most recently used bulb when no gain calculation was performed in this granule)
gain_err	32-bit floating-point	Channel (= 4) * SubTrack (= 9)	Error caused by imperfect fit for gain (gain units). (Same as gain_err_prev on most recently used bulb when no gain calculation was performed in this granule)
gain_prev	32-bit floating-point	Bulb (= 3) * GainHistory (= 5) * Channel (= 4) * SubTrack (= 9)	Previous Gain: number of radiance units per count at time of previous gain calculations for each bulb
gain_err_prev	32-bit floating-point	Bulb (= 3) *	gain_err for each gain_prev

	point	GainHistory (= 5) * Channel (= 4) * SubTrack (= 9)	
gain_start_TAI	64-bit floating-point	None	TAI time when photometric calibration source was turned "on" for a gain calculation that had started but had not finished collecting data at the end of the granule. (floating-point elapsed seconds since start of 1993) 0.0 for no gain calculation left partial at the end of this granule.
gain_num_counts	32-bit integer	Channel (= 4) * SubTrack (= 9)	The number of data points of counts per detector collected in gain_sum_counts and gain_num_counts2 for a gain calculation that had started but had not finished collecting data at the end of the granule. 0.0 for no gain calculation left partial at the end of this granule.
gain_sum_counts	64-bit floating-point	Channel (= 4) * SubTrack (= 9)	The sum of the counts per detector for a gain calculation that had started but had not finished collecting data at the end of the granule. 0.0 for no gain calculation left partial at the end of this granule.
gain_sum_counts2	64-bit floating-point	Channel (= 4) * SubTrack (= 9)	The sum of the squares of counts per detector for a gain calculation that had started but had not finished collecting data at the end of the granule. 0.0 for no gain calculation left partial at the end of this granule.
primary_bulb	16-bit integer	None	Bulb number of photometric calibration source used as primary bulb (1, 2, or 3; 0 for no primary bulb)
secondary_bulb	16-bit integer	None	Bulb number of photometric calibration source used as secondary bulb (1, 2, or 3; 0 for no secondary bulb)
backup_bulb	16-bit integer	None	Bulb number of photometric calibration source used as backup bulb (1, 2, or 3; 0 for no backup bulb)
K21	32-bit floating-point	Channel (= 4) * SubTrack (= 9)	Gain calculated using bulb 2, divided by gain using bulb 1. (Tracks degradation of bulb 1 relative to bulb 2.)
K32	32-bit floating-point	Channel (= 4) * SubTrack (= 9)	Gain calculated using bulb 3, divided by gain using bulb 2. (Tracks degradation of bulb 2 relative to bulb 3.)
K31	32-bit floating-point	Channel (= 4) * SubTrack (= 9)	Gain calculated using bulb 3, divided by gain using bulb 1. (Tracks degradation of bulb 1 relative to bulb 3.)
K_factors_applied	8-bit unsigned integer	Channel (= 4)	Flag if K factors were applied for each channel (1 for yes, 0 for no)
gamma_ground	32-bit floating-point	Channel (= 4) * SubTrack (= 9)	Correction factor applied to gain calculation based on observations of known ground targets
gamma_MODIS	32-bit floating-point	Channel (= 4) * SubTrack (= 9)	Correction factor applied to gain calculation based on co-located MODIS and AIRS observations
rad_stats	Unlimited Engineering Struct (see below)	Channel (= 4) * SubTrack (= 9)	Statistics over the granule of radiances (radiance units)
NeN_stats	Limited Engineering Struct (see below)	Channel (= 4) * SubTrack (= 9)	Statistics over the granule of Noise-equivalent Radiance (NeN)
granules_present	string of 8-bit characters	None	Zero-terminated character string denoting which adjacent granules were available for smoothing ("All" for both previous & next, "Prev" for previous but not next, "Next" for next but not previous, "None" for neither previous nor next)
xtrack_err	32-bit floating-point	Channel (= 4)	cross-track pixel location error estimate per channel (km)
track_err	32-bit floating-point	Channel (= 4)	Along-track pixel location error estimate per channel (km)
align_1_2_nadir	32-bit floating-point	None	Expected error (km) between the pixel locations for the corner locations of near-nadir AIRS footprints (45 & 46) between VIS channels 1 & 2
align_2_3_nadir	32-bit floating-point	None	Expected error (km) between the pixel locations for the corner locations of near-nadir AIRS footprints (45 & 46) between VIS channels 2 & 3
align_2_4_nadir	32-bit floating-point	None	Expected error (km) between the pixel locations for the corner locations of near-nadir AIRS footprints (45 & 46) between VIS channels 2 & 4
align_1_2_maxang	32-bit floating-point	None	Expected error (km) between the pixel locations for the corner locations of near-limb AIRS footprints (1 & 90) between VIS channels 1 & 2
align_2_3_maxang	32-bit floating-point	None	Expected error (km) between the pixel locations for the corner locations of near-limb AIRS footprints (1 & 90) between VIS channels 2 & 3
align_2_4_maxang	32-bit floating-point	None	Expected error (km) between the pixel locations for the corner locations of near-limb AIRS footprints (1 & 90) between VIS channels 2 & 4
align_vis_airs	32-bit floating-point	None	Expected error (km) between the pixel locations for the corner locations of near-nadir AIRS footprints (45 & 46) between the AIRS center and all VIS channels

Size: 32784 bytes (0.0 MB) per granule

## Along-Track Data Fields

These fields appear once per scanline (GeoTrack times)

Name	Type	Extra Dimensions	Explanation
satheight	32-bit floating-point	None	Satellite altitude at nadirTAI in km above reference ellipsoid (e.g. 725.2)
satroll	32-bit floating-point	None	Satellite attitude roll angle at nadirTAI (-180.0 ... 180.0 angle about the +x (roll) ORB axis, +x axis is positively oriented in the direction of orbital flight completing an orthogonal triad with y and z.)
satpitch	32-bit floating-point	None	Satellite attitude pitch angle at nadirTAI (-180.0 ... 180.0 angle about +y (pitch) ORB axis. +y axis is oriented normal to the orbit plane with the positive sense opposite to that of the orbit's angular momentum vector H.)
satyaw	32-bit floating-point	None	Satellite attitude yaw angle at nadirTAI (-180.0 ... 180.0 angle about +z (yaw) axis. +z axis is positively oriented earthward parallel to the satellite radius vector R from the spacecraft center of mass to the center of the Earth.)
satgeoqa	32-bit unsigned integer	None	Satellite Geolocation QA flags: bit 0 (LSB): bad input value; bit 1: PGS_TD_TAItUTC() returned PGSTD_E_NO_LEAP_SECS; bit 2: PGS_TD_TAItUTC() returned PGS_E_TOOLKIT; bit 3: PGS_EPH_EphemAttit() returned PGSEPH_W_BAD_EPHEM_VALUE; bit 4: PGS_EPH_EphemAttit() returned PGSEPH_E_BAD_EPHEM_FILE_HDR; bit 5: PGS_EPH_EphemAttit() returned PGSEPH_E_NO_SC_EPHEM_FILE; bit 6: PGS_EPH_EphemAttit() returned PGSEPH_E_NO_DATA_REQUESTED; bit 7: PGS_EPH_EphemAttit() returned PGSTD_E_SC_TAG_UNKNOWN; bit 8: PGS_EPH_EphemAttit() returned PGSEPH_E_BAD_ARRAY_SIZE; bit 9: PGS_EPH_EphemAttit() returned PGSTD_E_TIME_FMT_ERROR; bit 10: PGS_EPH_EphemAttit() returned PGSTD_E_TIME_VALUE_ERROR; bit 11: PGS_EPH_EphemAttit() returned PGSTD_E_NO_LEAP_SECS; bit 12: PGS_EPH_EphemAttit() returned PGS_E_TOOLKIT; bit 13: PGS_CSC_ECIttoECR() returned PGSCSC_W_BAD_TRANSFORM_VALUE; bit 14: PGS_CSC_ECIttoECR() returned PGSCSC_E_BAD_ARRAY_SIZE; bit 15: PGS_CSC_ECIttoECR() returned PGSTD_E_NO_LEAP_SECS; bit 16: PGS_CSC_ECIttoECR() returned PGSTD_E_TIME_FMT_ERROR; bit 17: PGS_CSC_ECIttoECR() returned PGSTD_E_TIME_VALUE_ERROR; bit 18: unused (set to zero); bit 19: PGS_CSC_ECIttoECR() returned PGSTD_E_NO_UT1_VALUE; bit 20: PGS_CSC_ECIttoECR() returned PGS_E_TOOLKIT; bit 21: PGS_CSC_ECRtoGEO() returned PGSCSC_W_TOO_MANY_ITERS; bit 22: PGS_CSC_ECRtoGEO() returned PGSCSC_W_INVALID_ALTITUDE; bit 23: PGS_CSC_ECRtoGEO() returned PGSCSC_W_SPHERE_BODY; bit 24: PGS_CSC_ECRtoGEO() returned PGSCSC_W_LARGE_FLATTENING; bit 25: PGS_CSC_ECRtoGEO() returned PGSCSC_W_DEFAULT_EARTH_MODEL; bit 26: PGS_CSC_ECRtoGEO() returned PGSCSC_E_BAD_EARTH_MODEL; bit 27: PGS_CSC_ECRtoGEO() returned PGS_E_TOOLKIT; bit 28-31: not used
glintgeoqa	16-bit unsigned integer	None	Glint Geolocation QA flags: bit 0 (LSB): bad input value; bit 1: glint location in Earth's shadow; bit 2: glint calculation not converging; bit 3: glint location sun vs. satellite zenith mismatch; bit 4: glint location sun vs. satellite azimuth mismatch; bit 5: bad glint location; bit 6: PGS_CSC_ZenithAzimuth() returned any 'W' class return code; bit 7: PGS_CSC_ZenithAzimuth() returned any 'E' class return code; bit 8: PGS_CBP_Earth_CB_Vector() returned returned any 'W' class return code; bit 9: PGS_CBP_Earth_CB_Vector() returned returned any 'E' class return code; bit 10: PGS_CSC_ECIttoECR() returned any 'W' class return code except PGSCSC_W_PREDICTED_UT1 (for Glint); bit 11: PGS_CSC_ECIttoECR() returned any 'E' class return code (for Glint); bit 12: PGS_CSC_ECRtoGEO() returned any 'W' class return code (for Glint); bit 13: PGS_CSC_ECRtoGEO() returned any 'E' class return code (for Glint); bit 14: PGS_CSC_ECIttoECR() returned any 'W' class return code except PGSCSC_W_PREDICTED_UT1; bit 15: PGS_CSC_ECIttoECR() returned any 'E' class return code
moongeoa	16-bit unsigned integer	None	Moon Geolocation QA flags: bit 0 (LSB): bad input value; bit 1: PGS_TD_TAItUTC() returned PGSTD_E_NO_LEAP_SECS; bit 2: PGS_TD_TAItUTC() returned PGS_E_TOOLKIT; bit 3: PGS_CBP_Sat_CB_Vector() returned PGSCSC_W_BELOW_SURFACE; bit 4: PGS_CBP_Sat_CB_Vector() returned PGSCBP_W_BAD_CB_VECTOR; bit 5: PGS_CBP_Sat_CB_Vector() returned PGSCBP_E_BAD_ARRAY_SIZE; bit 6: PGS_CBP_Sat_CB_Vector() returned PGSCBP_E_INVALID_CB_ID; bit 7: PGS_CBP_Sat_CB_Vector() returned PGSMEM_E_NO_MEMORY; bit 8: PGS_CBP_Sat_CB_Vector() returned PGSCBP_E_UNABLE_TO_OPEN_FILE; bit 9: PGS_CBP_Sat_CB_Vector() returned PGSTD_E_BAD_INITIAL_TIME; bit 10: PGS_CBP_Sat_CB_Vector() returned PGSCBP_E_TIME_OUT_OF_RANGE; bit 11: PGS_CBP_Sat_CB_Vector() returned PGSTD_E_SC_TAG_UNKNOWN; bit 12: PGS_CBP_Sat_CB_Vector() returned PGSEPH_E_BAD_EPHEM_FILE_HDR; bit 13: PGS_CBP_Sat_CB_Vector() returned PGSEPH_E_NO_SC_EPHEM_FILE; bit 14: PGS_CBP_Sat_CB_Vector() returned PGS_E_TOOLKIT; bit 15: not used
nadirTAI	64-bit floating-point	None	TAI time at which instrument is nominally looking directly down. (between footprints 15 & 16 for AMSU or between footprints 45 & 46 for AIRS/Vis & HSB) (floating-point elapsed seconds since start of 1993)
sat_lat	64-bit floating-point	None	Satellite geodetic latitude in degrees North (-90.0 ... 90.0)
sat_lon	64-bit floating-point	None	Satellite geodetic longitude in degrees East (-180.0 ... 180.0)
scan_node_type	8-bit integer	None	'A' for ascending, 'D' for descending, 'N' for North-Polar, 'S' for South-Polar
glintlat	32-bit floating-point	None	Solar glint geodetic latitude in degrees North at nadirTAI (-90.0 ... 90.0)
glintlon	32-bit floating-point	None	Solar glint geodetic longitude in degrees East at nadirTAI (-180.0 ... 180.0)

	point		
ViSnrArrTemp	32-bit floating-point	None	Vis/NIR Sensor Array Temperature (Celcius)
ScHeadTemp1	32-bit floating-point	None	Scanner Head Housing Temperature 1 (active A or B) (Celcius)
OpMode	16-bit unsigned integer	None	Instrument Operations Mode. See AIRS Command Handbook, section 6.4 for a definition of each bit. bits 0 (LSB)-2 cal phase; bits 3-6 Cal Func; bit 7 quicklook (expedited) flag; bits 8-11 submode bits 12-14 Mode (0=standby, 1=ready, 2=operate, 3=checkout, 4=decontaminate, 5=off, 6=survival); bit 16 transition flag

Size: 9045 bytes (0.0 MB) per 45-scanset granule

## Full Swath Data Fields

These fields appear for every footprint of every scanline in the granule (GeoTrack \* GeoXTrack times)

Name	Type	Extra Dimensions	Explanation
scanang	32-bit floating-point	None	Scanning angle of AIRS instrument with respect to the AIRS Instrument for this footprint (-180.0 ... 180.0, negative at start of scan, 0 at nadir)
ftptgeoqa	32-bit unsigned integer	None	Footprint Geolocation QA flags: bit 0 (LSB): bad input value; bit 1: PGS_TD_TAItoUTC() returned PGSTD_E_NO_LEAP_SECS; bit 2: PGS_TD_TAItoUTC() returned PGS_E_TOOLKIT; bit 3: PGS_CSC_GetFOV_Pixel() returned PGSCSC_W_MISS_EARTH; bit 4: PGS_CSC_GetFOV_Pixel() returned PGSTD_E_SC_TAG_UNKNOWN; bit 5: PGS_CSC_GetFOV_Pixel() returned PGSCSC_W_ZERO_PIXEL_VECTOR; bit 6: PGS_CSC_GetFOV_Pixel() returned PGSCSC_W_BAD_EPH_FOR_PIXEL; bit 7: PGS_CSC_GetFOV_Pixel() returned PGSCSC_W_INSTRUMENT_OFF_BOARD; bit 8: PGS_CSC_GetFOV_Pixel() returned PGSCSC_W_BAD_ACCURACY_FLAG; bit 9: PGS_CSC_GetFOV_Pixel() returned PGSCSC_E_BAD_ARRAY_SIZE; bit 10: PGS_CSC_GetFOV_Pixel() returned PGSCSC_W_DEFAULT_EARTH_MODEL; bit 11: PGS_CSC_GetFOV_Pixel() returned PGSCSC_W_DATA_FILE_MISSING; bit 12: PGS_CSC_GetFOV_Pixel() returned PGSCSC_E_NEG_OR_ZERO_RAD; bit 13: PGS_CSC_GetFOV_Pixel() returned PGSMEM_E_NO_MEMORY; bit 14: PGS_CSC_GetFOV_Pixel() returned PGSTD_E_NO_LEAP_SECS; bit 15: PGS_CSC_GetFOV_Pixel() returned PGSTD_E_TIME_FMT_ERROR; bit 16: PGS_CSC_GetFOV_Pixel() returned PGSTD_E_TIME_VALUE_ERROR; bit 17: PGS_CSC_GetFOV_Pixel() returned PGSCSC_W_PREDICTED_UT1; bit 18: PGS_CSC_GetFOV_Pixel() returned PGSTD_E_NO_UT1_VALUE; bit 19: PGS_CSC_GetFOV_Pixel() returned PGS_E_TOOLKIT; bit 20: PGS_CSC_GetFOV_Pixel() returned PGSEPH_E_BAD_EPHEM_FILE_HDR; bit 21: PGS_CSC_GetFOV_Pixel() returned PGSEPH_E_NO_SC_EPHEM_FILE; bit 22-31: not used
zengeoqa	16-bit unsigned integer	None	Satellite zenith Geolocation QA flags: bit 0 (LSB): (Spacecraft) bad input value; bit 1: PGS_CSC_ZenithAzimuth(S/C) returned PGSCSC_W_BELOW_HORIZON; bit 2: PGS_CSC_ZenithAzimuth(S/C) returned PGSCSC_W_UNDEFINED_AZIMUTH; bit 3: PGS_CSC_ZenithAzimuth(S/C) returned PGSCSC_W_NO_REFRACTION; bit 4: PGS_CSC_ZenithAzimuth(S/C) returned PGSCSC_E_INVALID_VECTAG; bit 5: PGS_CSC_ZenithAzimuth(S/C) returned PGSCSC_E_LOOK_PT_ALTIT_RANGE; bit 6: PGS_CSC_ZenithAzimuth(S/C) returned PGSCSC_E_ZERO_INPUT_VECTOR; bit 7: PGS_CSC_ZenithAzimuth(S/C) returned PGS_E_TOOLKIT; bit 8: (Sun) bad input value; bit 9: (suppressed) PGS_CSC_ZenithAzimuth(Sun) returned PGSCSC_W_BELOW_HORIZON (This is not an error condition - the sun is below the horizon at night); bit 10: PGS_CSC_ZenithAzimuth(Sun) returned PGSCSC_W_UNDEFINED_AZIMUTH; bit 11: PGS_CSC_ZenithAzimuth(Sun) returned PGSCSC_W_NO_REFRACTION; bit 12: PGS_CSC_ZenithAzimuth(Sun) returned PGSCSC_E_INVALID_VECTAG; bit 13: PGS_CSC_ZenithAzimuth(Sun) returned PGSCSC_E_LOOK_PT_ALTIT_RANGE; bit 14: PGS_CSC_ZenithAzimuth(Sun) returned PGSCSC_E_ZERO_INPUT_VECTOR; bit 15: PGS_CSC_ZenithAzimuth(Sun) returned PGS_E_TOOLKIT
demgeoqa	16-bit unsigned integer	None	Digital Elevation Model (DEM) Geolocation QA flags: bit 0 (LSB): bad input value; bit 1: Could not allocate memory; bit 2: Too close to North or South pole. Excluded; bit 3: Layer resolution incompatibility. Excluded; bit 4: Any DEM Routine (elev) returned PGSDDEM_E_IMPROPER_TAG; bit 5: Any DEM Routine (elev) returned PGSDDEM_E_CANNOT_ACCESS_DATA; bit 6: Any DEM Routine (land/water) returned PGSDDEM_E_IMPROPER_TAG; bit 7: Any DEM Routine (land/water) returned PGSDDEM_E_CANNOT_ACCESS_DATA; bit 8: Reserved for future layers; bit 9: Reserved for future layers; bit 10: PGS_DEM_GetRegion(elev) returned PGSDDEM_M_FILLVALUE_INCLUDED; bit 11: PGS_DEM_GetRegion(land/water) returned PGSDDEM_M_FILLVALUE_INCLUDED; bit 12: Reserved for future layers; bit 13: PGS_DEM_GetRegion(all) returned PGSDDEM_M_MULTIPLE_RESOLUTIONS; bit 14: PGS_CSC_GetFOV_Pixel() returned any 'W' class return code except PGSCSC_W_PREDICTED_UT1; bit 15: PGS_CSC_GetFOV_Pixel() returned any 'E' class return code
satzen	32-bit floating-point	None	Spacecraft zenith angle (0.0 ... 180.0) degrees from zenith (measured relative to the geodetic vertical on the reference (WGS84) spheroid and including corrections outlined in EOS SDP toolkit for normal accuracy.)
satazi	32-bit floating-point	None	Spacecraft azimuth angle (-180.0 ... 180.0) degrees E of N GEO)
solzen	32-bit floating-point	None	Solar zenith angle (0.0 ... 180.0) degrees from zenith (measured relative to the geodetic vertical on the reference (WGS84) spheroid and including corrections outlined in EOS SDP toolkit for normal accuracy.)
solazi	32-bit floating-point	None	Solar azimuth angle (-180.0 ... 180.0) degrees E of N GEO)



sun_glint_distance	16-bit integer	None	Distance (km) from footprint center to location of the sun glint (-9999 for unknown, 30000 for no glint visible because spacecraft is in Earth's shadow)
topog	32-bit floating-point	None	Mean topography in meters above reference ellipsoid
topog_err	32-bit floating-point	None	Error estimate for topog
landFrac	32-bit floating-point	None	Fraction of spot that is land (0.0 ... 1.0)
landFrac_err	32-bit floating-point	None	Error estimate for landFrac
state	32-bit integer	None	Data state: 0:Process, 1:Special, 2:Erroneous, 3:Missing

Size: 607500 bytes (0.6 MB) per 45-scanset granule

**Total File Size (plus storage for dimensions and other HDF-EOS overhead): 940929 bytes (0.9 MB) per 45-scanset granule = 225.8 MB per day**

## Special AIRS Types

Limited Engineering Struct: This type is used for engineering data fields for which there are known "yellow" limits

Field Name	Type	Explanation
min	32-bit floating-point	Minimum value field takes on in granule (not valid when num_in = 0)
max	32-bit floating-point	Maximum value field takes on in granule (not valid when num_in = 0)
mean	32-bit floating-point	Mean of in-range values field takes on in granule (not valid when num_in = 0)
dev	32-bit floating-point	Standard Deviation of in-range values field takes on in granule (not valid when num_in = 0)
num_in	32-bit integer	Count of in-range values field takes on in granule
num_lo	32-bit integer	Count of out-of-range low values field takes on in granule
num_hi	32-bit integer	Count of out-of-range high values field takes on in granule
num_bad	32-bit integer	Count of occasions on which field takes on invalid flag value (-9999) in granule
range_min	32-bit floating-point	Minimum in-range value. Any value less than this is counted in num_lo and is not used in the calculation of mean & dev.
range_max	32-bit floating-point	Maximum in-range value. Any value greater than this is counted in num_hi and is not used in the calculation of mean & dev.
missing	8-bit integer	Missing limits flags. Bit 0 (LSB) is 1 when yellow low (range_min) limit is missing; Bit 1 is high when yellow high (range_max) limit is missing; other bits unused, set to 0.
max_track	32-bit integer	GeoTrack index (counting from 1) where max was found
max_xtrack	32-bit integer	GeoXTrack index (counting from 1) where max was found
min_track	32-bit integer	GeoTrack index (counting from 1) where min was found
min_xtrack	32-bit integer	GeoXTrack index (counting from 1) where min was found

Unlimited Engineering Struct: This type is used for engineering data fields for which there are NOT known "yellow" limits

Field Name	Type	Explanation
min	32-bit floating-point	Minimum value field takes on in granule (not valid when num = 0)
max	32-bit floating-point	Maximum value field takes on in granule (not valid when num = 0)
mean	32-bit floating-point	Mean of values field takes on in granule (not valid when num = 0)
dev	32-bit floating-point	Standard Deviation of values field takes on in granule (not valid when num = 0)
num	32-bit integer	Count of occurrences of field in granule (not including those counted in num_bad)
num_bad	32-bit integer	Count of occasions on which field takes on invalid flag value (-9999) in granule
max_track	32-bit integer	GeoTrack index (counting from 1) where max was found
max_xtrack	32-bit integer	GeoXTrack index (counting from 1) where max was found
min_track	32-bit integer	GeoTrack index (counting from 1) where min was found
min_xtrack	32-bit integer	GeoXTrack index (counting from 1) where min was found

Color Counts: This type tracks counts of values received during an interval by how they compare to corresponding "red" and "yellow" limits

Field Name	Type	Explanation
red_lo_limit	32-bit floating-point	Value of the low "red" limit.
red_lo_cnt	32-bit integer	Count of values less than the low "red" limit. This is an "Alarm" condition.
to_red_lo	32-bit integer	Count of occasions on which the "color" of this field changed from some other value to "red_low".
yellow_lo_limit	32-bit floating-point	Value of the low "yellow" limit.
yellow_lo_cnt	32-bit integer	Count of values greater than the low "red" limit but less than the low "yellow" limit. This is a "Warning" condition.
to_yellow_lo	32-bit integer	Count of occasions on which the "color" of this field changed from some other value to "yellow_low".
green_cnt	32-bit integer	Count of values greater than the low "yellow" limit but less than the high "yellow" limit.
to_green	32-bit integer	Count of occasions on which the "color" of this field changed from some other value to "green".
yellow_hi_limit	32-bit floating-point	Value of the high "yellow" limit.
yellow_hi_cnt	32-bit integer	Count of values greater than the high "yellow" limit but less than the high "red" limit. This is a "Warning" condition.
to_yellow_hi	32-bit integer	Count of occasions on which the "color" of this field changed from some other value to "yellow_high".
red_hi_limit	32-bit floating-point	Value of the high "red" limit.
red_hi_cnt	32-bit integer	Count of values greater than the high "red" limit. This is an "Alarm" condition.
to_red_hi	32-bit integer	Count of occasions on which the "color" of this field changed from some other value to "red_high".
missing	8-bit integer	Missing limits flags. Bit 0 (LSB) is 1 when yellow low limit (yellow_lo_limit) is missing; Bit 1 is high when yellow high limit is missing; Bit 2 is 1 when red low limit is missing; Bit 3 is 1 when red high limit is missing; Other bits unused set to 0.

## A-5. L1B AMSU-A Science Interface Specification

Interface Specification Version 3.0.4.0  
2003-05-19

ESDT ShortName = "AIRABRAD"

Swath Name = "L1B\_AMSU"

Level = "level1B"

# Footprints = 30

# scanlines per scanset = 1

### Dimensions

These fields define all dimensions that can be used for HDF-EOS swath fields.

The names "GeoTrack" and "GeoXTrack" have a special meaning for this document: "Cross-Track" data fields have a hidden dimension of "GeoXTrack"; "Along-Track" data fields have a hidden dimension of "GeoTrack"; "Full Swath Data Fields" have hidden dimensions of both "GeoTrack" and "GeoXTrack".

Name	Value	Explanation
GeoXTrack	30	Dimension across track for footprint positions. Same as number of footprints per scanline. -- starting at the left and increasing towards the right as you look along the satellite's path
GeoTrack	# of scanlines in swath	Dimension along track for footprint positions. Same as number of scanlines in granule. Parallel to the satellite's path, increasing with time. (Nominally 45 for Level-2, AMSU-A, and AIRS/Vis low-rate engineering; 135 for AIRS/Vis and HSB high-rate quantities)
Channel	15	Dimension of channel array (Channel 1: 23.8 GHz; Ch 2: 31.4 GHz; Ch 3: 50.3 GHz; Ch 4: 52.8 GHz; Ch 5: 53.596 +/- 0.115 GHz; Ch 6: 54.4 GHz; Ch 7: 54.94 GHz; Ch 8: 55.5 GHz; Ch 9: f0; Ch 10: f0 +/- 0.217 GHz Ch 11: f0 +/- df +/- 48 MHz; Ch 12: f0 +/- df +/- 22 MHz; Ch 13: f0 +/- df +/- 10 MHz; Ch 14: f0 +/- df +/- 4.5 MHz; Ch 15: 89 GHz (f0 = 57290.344 MHz; df = 322.4 MHz))
CalXTrack	4	Dimension "across" track for calibration footprint positions. Same as number of calibration footprints per scanline. (NUM_FOOTPRINTS_AMSU_CALIB) (Footprints are ordered: 1-2: spaceviews; 3-4: blackbody radiometric calibration source)
SpaceXTrack	2	Dimension "across" track for spaceview calibration footprint positions in order of observation time. (NUM_FOOTPRINTS_AMSU_SPACE)
BBXTrack	2	Dimension "across" track for blackbody calibration footprint positions in order of observation time. (NUM_FOOTPRINTS_AMSU_BB)
WarmPRTA11	5	Number of PRTs measuring AMSU-A1-1 warm target (AMSU-A1-1 is AMSU-A channels 6, 7, 9-15)
WarmPRTA12	5	Number of PRTs measuring AMSU-A1-2 warm target (AMSU-A1-2 is AMSU-A channels 3, 4, 5, and 8)
WarmPRTA2	7	Number of PRTs measuring AMSU-A2 warm target (AMSU-A2 is AMSU-A channels 1 & 2)

### Geolocation Fields

These fields appear for every footprint (GeoTrack \* GeoXTrack times) and correspond to footprint center coordinates and "shutter" time.

Name	Explanation
Latitude	Footprint boresight geodetic Latitude in degrees North (-90.0 ... 90.0)
Longitude	Footprint boresight geodetic Longitude in degrees East (-180.0 ... 180.0)
Time	Footprint "shutter" TAI Time: floating-point elapsed seconds since Jan 1, 1993

Size: 32400 bytes (0.0 MB) per 45-scanset granule

### Attributes

These fields appear only once per granule

Name	Type	Extra Dimensions	Explanation
processing_level	string of 8-bit characters	None	Zero-terminated character string denoting processing level ("level1B")
instrument	string of 8-bit characters	None	Zero-terminated character string denoting instrument ("AMSU-A")
DayNightFlag	string of 8-bit characters	None	Zero-terminated character string denoting granule as day and/or night: (Always "Day", "Night", or "Both")
AutomaticQAFlag	string of 8-bit characters	None	Zero-terminated character string denoting granule data quality: (Always "Passed", "Failed", or "Suspect")
NumTotalData	32-bit integer	None	Total number of expected channels * scene FOVs

NumProcessData	32-bit integer	None	Number of channels * scene FOVs which are present and can be processed routinely (state = 0)
NumSpecialData	32-bit integer	None	Number of channels * scene FOVs which are present and can be processed only as a special test (state = 1)
NumBadData	32-bit integer	None	Number of channels * scene FOVs which are present but cannot be processed (state = 2)
NumMissingData	32-bit integer	None	Number of expected channels * scene FOVs which are not present (state = 3)
NumLandSurface	32-bit integer	None	Number of scene footprints for which the surface is more than 90% land
NumOceanSurface	32-bit integer	None	Number of scene footprints for which the surface is less than 10% land
node_type	string of 8-bit characters	None	Zero-terminated character string denoting whether granule is ascending, descending, or pole-crossing: ("Ascending" and "Descending" for entirely ascending or entirely descending granules, or "NorthPole" or "SouthPole" for pole-crossing granules)
start_year	32-bit integer	None	Year in which granule started, UTC (e.g. 1999)
start_month	32-bit integer	None	Month in which granule started, UTC (1 ... 12)
start_day	32-bit integer	None	Day of month in which granule started, UTC (1 ... 31)
start_hour	32-bit integer	None	Hour of day in which granule started, UTC (0 ... 23)
start_minute	32-bit integer	None	Minute of hour in which granule started, UTC (0 ... 59)
start_sec	32-bit floating-point	None	Second of minute in which granule started, UTC (0.0 ... 59.0)
start_orbit	32-bit integer	None	Orbit number of mission in which granule started
end_orbit	32-bit integer	None	Orbit number of mission in which granule ended
orbit_path	32-bit integer	None	Orbit path of start orbit (1 ... 233 as defined by EOS project)
start_orbit_row	32-bit integer	None	Orbit row at start of granule (1 ... 248 as defined by EOS project)
end_orbit_row	32-bit integer	None	Orbit row at end of granule (1 ... 248 as defined by EOS project)
granule_number	32-bit integer	None	Number of granule within day (1 ... 240)
num_scansets	32-bit integer	None	Number of scansets in granule (1 ... 45)
num_scanlines	32-bit integer	None	Number of scanlines in granule (1 * num_scansets)
start_Latitude	64-bit floating-point	None	Geodetic Latitude of spacecraft at start of granule in degrees North (-90.0 ... 90.0)
start_Longitude	64-bit floating-point	None	Geodetic Longitude of spacecraft at start of granule in degrees East (-180.0 ... 180.0)
start_Time	64-bit floating-point	None	TAI Time at start of granule (floating-point elapsed seconds since start of 1993)
end_Latitude	64-bit floating-point	None	Geodetic Latitude of spacecraft at end of granule in degrees North (-90.0 ... 90.0)
end_Longitude	64-bit floating-point	None	Geodetic Longitude of spacecraft at end of granule in degrees East (-180.0 ... 180.0)
end_Time	64-bit floating-point	None	TAI Time at end of granule (floating-point elapsed seconds since start of 1993)
eq_x_longitude	32-bit floating-point	None	Longitude of spacecraft at southward equator crossing nearest granule start in degrees East (-180.0 ... 180.0)
eq_x_tai	64-bit floating-point	None	Time of eq_x_longitude in TAI units (floating-point elapsed seconds since start of 1993)
orbitgeoqa	32-bit unsigned integer	None	Orbit Geolocation QA: bit 0 (LSB): bad input value (last scanline); bit 1: bad input value (first scanline); bit 2: PGS_EPH_GetEphMet() returned PGSEPH_E_NO_SC_EPHEM_FILE; bit 3: PGS_EPH_GetEphMet() returned PGSEPH_E_BAD_ARRAY_SIZE; bit 4: PGS_EPH_GetEphMet() returned PGSTD_E_TIME_FMT_ERROR; bit 5: PGS_EPH_GetEphMet() returned PGSTD_E_TIME_VALUE_ERROR; bit 6: PGS_EPH_GetEphMet() returned PGSTD_E_SC_TAG_UNKNOWN; bit 7: PGS_EPH_GetEphMet() returned PGS_E_TOOLKIT; bit 8: PGS_TD_UTCtoTAI() returned PGSTD_E_NO_LEAP_SECS; bit 9: PGS_TD_UTCtoTAI() returned PGSTD_E_TIME_FMT_ERROR; bit 10: PGS_TD_UTCtoTAI() returned PGSTD_E_TIME_VALUE_ERROR; bit 11: PGS_TD_UTCtoTAI() returned PGS_E_TOOLKIT; bit 12: PGS_CSC_DayNight() returned PGSTD_E_NO_LEAP_SECS; bit 13: PGS_CSC_DayNight() returned PGSCSC_E_INVALID_LIMITTAG; bit 14: PGS_CSC_DayNight() returned PGSCSC_E_BAD_ARRAY_SIZE; bit 15: PGS_CSC_DayNight() returned PGSCSC_W_ERROR_IN_DAYNIGHT; bit 16: PGS_CSC_DayNight() returned PGSCSC_W_BAD_TRANSFORM_VALUE; bit 17: PGS_CSC_DayNight() returned PGSCSC_W_BELOW_HORIZON; bit 18: PGS_CSC_DayNight() returned PGSCSC_W_PREDICTED_UT1; bit 19: PGS_CSC_DayNight() returned PGSTD_F_NO_IT1_VALID; bit 20: PGS_CSC_DayNight()

			returned PGSTD_E_BAD_INITIAL_TIME; bit 21: PGS_CSC_DayNight() returned PGSCBP_E_TIME_OUT_OF_RANGE; bit 22: PGS_CSC_DayNight() returned PGSCBP_E_UNABLE_TO_OPEN_FILE; bit 22: PGS_CSC_DayNight() returned PGSMEM_E_NO_MEMORY; bit 24: PGS_CSC_DayNight() returned PGS_E_TOOLKIT; bit 25-31: not used
num_satgeoqa	16-bit integer	None	Number of scans with problems in satgeoqa
num_glintgeoqa	16-bit integer	None	Number of scans with problems in glintgeoqa
num_moongeoqa	16-bit integer	None	Number of scans with problems in moongeoqa
num_ftptgeoqa	16-bit integer	None	Number of footprints with problems in ftptgeoqa
num_zengeoqa	16-bit integer	None	Number of footprints with problems in zengeoqa
num_demgeoqa	16-bit integer	None	Number of footprints with problems in demgeoqa
num_fpe	16-bit integer	None	Number of floating point errors
LonGranuleCen	16-bit integer	None	Geodetic Longitude of the center of the granule in degrees East (-180 ... 180)
LatGranuleCen	16-bit integer	None	Geodetic Latitude of the center of the granule in degrees North (-90 ... 90)
LocTimeGranuleCen	16-bit integer	None	Local solar time at the center of the granule in minutes past midnight (0 ... 1439)
center_freq	32-bit floating-point	Channel (= 15)	Channel Center frequency (GHz)
IF_offset_1	32-bit floating-point	Channel (= 15)	Offset of first intermediate frequency stage (MHz) (zero for no mixing)
IF_offset_2	32-bit floating-point	Channel (= 15)	Offset of second intermediate frequency stage (MHz) (zero for no second mixing)
bandwidth	32-bit floating-point	Channel (= 15)	bandwidth of sum of 1, 2, or 4 channels (MHz)
num_scanlines_not_norm_mode_a1	32-bit integer	None	Number of scanlines not in Process state (AMSU-A1) (AMSU-A1 is AMSU-A channels 3-15)
num_scanlines_not_norm_mode_a2	32-bit integer	None	Number of scanlines not in Process state (AMSU-A2) (AMSU-A2 is AMSU-A channels 1 and 2)
num_calibrated_scanlines	32-bit integer	Channel (= 15)	Number of scanlines that had calibration coefs applied
num_missing_scanlines_a1	32-bit integer	None	Number of scanlines with state = missing (AMSU-A1) (AMSU-A1 is AMSU-A channels 3-15)
num_missing_scanlines_a2	32-bit integer	None	Number of scanlines with state = missing (AMSU-A2) (AMSU-A2 is AMSU-A channels 1 and 2)
num_data_gaps_a1	32-bit integer	None	Number of blocks of scanlines where State is not Process (AMSU-A1) (AMSU-A1 is AMSU-A channels 3-15)
num_data_gaps_a2	32-bit integer	None	Number of blocks of scanlines where State is not Process (AMSU-A2) (AMSU-A2 is AMSU-A channels 1 and 2)
num_instr_mode_changes_a1	32-bit integer	None	Number of operational instrument mode changes (AMSU-A1) (AMSU-A1 is AMSU-A channels 3-15)
num_instr_mode_changes_a2	32-bit integer	None	Number of operational instrument mode changes (AMSU-A2) (AMSU-A2 is AMSU-A channels 1 and 2)
num_scanlines_rec_cal_prob_a11	32-bit integer	None	Number of scanlines with non-zero qa_receiver (AMSU-A1-1) (AMSU-A1-1 is AMSU-A channels 6, 7, 9-15)
num_scanlines_rec_cal_prob_a12	32-bit integer	None	Number of scanlines with non-zero qa_receiver (AMSU-A1-2) (AMSU-A1-2 is AMSU-A channels 3, 4, 5, and 8)
num_scanlines_rec_cal_prob_a2	32-bit integer	None	Number of scanlines with non-zero qa_receiver (AMSU-A2) (AMSU-A2 is AMSU-A channels 1 and 2)
num_scanlines_ch_cal_problems	32-bit integer	Channel (= 15)	Number of scanlines with non-zero qa_channel
num_scanlines_sig_coast_xing	32-bit integer	None	Number of scanlines with qa_scanline coast crossing bit set
num_scanlines_sig_sun_glint	32-bit integer	None	Number of scanlines with qa_scanline sun glint bit set
MoonInViewMWCount	32-bit integer	None	Number of scanlines in granule with the moon in the AMSU-A1 space view plus number of scanlines in granule with the moon in the AMSU-A2 space view (0-90)
QA_unfiltered_scene_count	Unlimited Engineering Struct (see below)	GeoXTrack (= 30) * Channel (= 15)	Per footprint position raw scene count summary QA
QA_unfiltered_BB_count	Unlimited Engineering Struct (see below)	BBXTrack (= 2) * Channel (= 15)	Per BB footprint position raw warm count summary QA (unfiltered)
QA_unfiltered_space_count	Unlimited	SpaceXTrack	Per space footprint position raw cold count summary QA (unfiltered)

	Engineering Struct (see below)	(= 2) * Channel (= 15)	
QA_bb_PRT_a11	Limited Engineering Struct (see below)	None	Blackbody PRT temperature summary QA (AMSU-A1-1) (AMSU-A1-1 is AMSU-A channels 6, 7, 9-15) (C)
QA_bb_PRT_a12	Limited Engineering Struct (see below)	None	Blackbody PRT temperature summary QA (AMSU-A1-2) (AMSU-A1-2 is AMSU-A channels 3, 4, 5, and 8) (C)
QA_bb_PRT_a2	Limited Engineering Struct (see below)	None	Blackbody PRT temperature summary QA (AMSU-A2) (AMSU-A2 is AMSU-A channels 1 and 2) (C)
QA_rec_PRT_a11	Limited Engineering Struct (see below)	None	Receiver PRT temperature summary QA (AMSU-A1-1) (AMSU-A1-1 is AMSU-A channels 6, 7, 9-15) (C)
QA_rec_PRT_a12	Limited Engineering Struct (see below)	None	Receiver PRT temperature summary QA (AMSU-A1-2) (AMSU-A1-2 is AMSU-A channels 3, 4, 5, and 8) (C)
QA_rec_PRT_a2	Limited Engineering Struct (see below)	None	Receiver PRT temperature summary QA (AMSU-A2) (AMSU-A2 is AMSU-A channels 1 and 2) (C)
QA_cal_coef_a0	Unlimited Engineering Struct (see below)	Channel (= 15)	Calibration coefficient a0 summary QA (K)
QA_cal_coef_a1	Unlimited Engineering Struct (see below)	Channel (= 15)	Calibration coefficient a1 summary QA (K/count)
QA_cal_coef_a2	Unlimited Engineering Struct (see below)	Channel (= 15)	Calibration coefficient a2 summary QA (K/count**2)
QA_bb_raw_noise_counts	Unlimited Engineering Struct (see below)	Channel (= 15)	Summary QA on differences between warm cal counts
QA_sv_raw_noise_counts	Unlimited Engineering Struct (see below)	Channel (= 15)	Summary QA on differences between cold cal counts
QA_NeDT	Unlimited Engineering Struct (see below)	Channel (= 15)	Summary QA on gain * differences between warm cal counts (K)
QA_NeDT2NomRatio	Unlimited Engineering Struct (see below)	Channel (= 15)	Summary QA on gain * differences between warm cal counts over nominal NeDT (unitless)
granules_present	string of 8-bit characters	None	Zero-terminated character string denoting which adjacent granules were available for smoothing ("All" for both previous & next, "Prev" for previous but not next, "Next" for next but not previous, "None" for neither previous nor next)

Size: 35510 bytes (0.0 MB) per granule

## Along-Track Data Fields

These fields appear once per scanline (GeoTrack times)

Name	Type	Extra Dimensions	Explanation
satheight	32-bit floating-point	None	Satellite altitude at nadirTAI in km above reference ellipsoid (e.g. 725.2)
satroll	32-bit floating-point	None	Satellite attitude roll angle at nadirTAI (-180.0 ... 180.0 angle about the +x (roll) ORB axis, +x axis is positively oriented in the direction of orbital flight completing an orthogonal triad with y and z.)
satpitch	32-bit floating-point	None	Satellite attitude pitch angle at nadirTAI (-180.0 ... 180.0 angle about +y (pitch) ORB axis, +y axis is oriented normal to the orbit plane with the positive sense opposite to that of the orbit's angular momentum vector H.)

satyaw	32-bit floating-point	None	Satellite attitude yaw angle at nadirTAI (-180.0 ... 180.0 angle about +z (yaw) axis. +z axis is positively oriented earthward parallel to the satellite radius vector R from the spacecraft center of mass to the center of the Earth.)
satgeoqa	32-bit unsigned integer	None	Satellite Geolocation QA flags: bit 0 (LSB): bad input value; bit 1: PGS_TD_TAItUTC() returned PGSTD_E_NO_LEAP_SECS; bit 2: PGS_TD_TAItUTC() returned PGS_E_TOOLKIT; bit 3: PGS_EPH_EphemAttit() returned PGSEPH_W_BAD_EPHEM_VALUE; bit 4: PGS_EPH_EphemAttit() returned PGSEPH_E_BAD_EPHEM_FILE_HDR; bit 5: PGS_EPH_EphemAttit() returned PGSEPH_E_NO_SC_EPHEM_FILE; bit 6: PGS_EPH_EphemAttit() returned PGSEPH_E_NO_DATA_REQUESTED; bit 7: PGS_EPH_EphemAttit() returned PGSTD_E_SC_TAG_UNKNOWN; bit 8: PGS_EPH_EphemAttit() returned PGSEPH_E_BAD_ARRAY_SIZE; bit 9: PGS_EPH_EphemAttit() returned PGSTD_E_TIME_FMT_ERROR; bit 10: PGS_EPH_EphemAttit() returned PGSTD_E_TIME_VALUE_ERROR; bit 11: PGS_EPH_EphemAttit() returned PGSTD_E_NO_LEAP_SECS; bit 12: PGS_EPH_EphemAttit() returned PGS_E_TOOLKIT; bit 13: PGS_CSC_ECItECR() returned PGSCSC_W_BAD_TRANSFORM_VALUE; bit 14: PGS_CSC_ECItECR() returned PGSCSC_E_BAD_ARRAY_SIZE; bit 15: PGS_CSC_ECItECR() returned PGSTD_E_NO_LEAP_SECS; bit 16: PGS_CSC_ECItECR() returned PGSTD_E_TIME_FMT_ERROR; bit 17: PGS_CSC_ECItECR() returned PGSTD_E_TIME_VALUE_ERROR; bit 18: unused (set to zero); bit 19: PGS_CSC_ECItECR() returned PGSTD_E_NO_UT1_VALUE; bit 20: PGS_CSC_ECItECR() returned PGS_E_TOOLKIT; bit 21: PGS_CSC_ECRtoGEO() returned PGSCSC_W_TOO_MANY_ITERS; bit 22: PGS_CSC_ECRtoGEO() returned PGSCSC_W_INVALID_ALTITUDE; bit 23: PGS_CSC_ECRtoGEO() returned PGSCSC_W_SPHERE_BODY; bit 24: PGS_CSC_ECRtoGEO() returned PGSCSC_W_LARGE_FLATTENING; bit 25: PGS_CSC_ECRtoGEO() returned PGSCSC_W_DEFAULT_EARTH_MODEL; bit 26: PGS_CSC_ECRtoGEO() returned PGSCSC_E_BAD_EARTH_MODEL; bit 27: PGS_CSC_ECRtoGEO() returned PGS_E_TOOLKIT; bit 28-31: not used
glintgeoqa	16-bit unsigned integer	None	Glint Geolocation QA flags: bit 0 (LSB): bad input value; bit 1: glint location in Earth's shadow; bit 2: glint calculation not converging; bit 3: glint location sun vs. satellite zenith mismatch; bit 4: glint location sun vs. satellite azimuth mismatch; bit 5: bad glint location; bit 6: PGS_CSC_ZenithAzimuth() returned any 'W' class return code; bit 7: PGS_CSC_ZenithAzimuth() returned any 'E' class return code; bit 8: PGS_CBP_Earth_CB_Vector() returned any 'W' class return code; bit 9: PGS_CBP_Earth_CB_Vector() returned any 'E' class return code; bit 10: PGS_CSC_ECItECR() returned any 'W' class return code except PGSCSC_W_PREDICTED_UT1 (for Glint); bit 11: PGS_CSC_ECItECR() returned any 'E' class return code (for Glint); bit 12: PGS_CSC_ECRtoGEO() returned any 'W' class return code (for Glint); bit 13: PGS_CSC_ECRtoGEO() returned any 'E' class return code (for Glint); bit 14: PGS_CSC_ECItECR() returned any 'W' class return code except PGSCSC_W_PREDICTED_UT1; bit 15: PGS_CSC_ECItECR() returned any 'E' class return code
moongeoqa	16-bit unsigned integer	None	Moon Geolocation QA flags: bit 0 (LSB): bad input value; bit 1: PGS_TD_TAItUTC() returned PGSTD_E_NO_LEAP_SECS; bit 2: PGS_TD_TAItUTC() returned PGS_E_TOOLKIT; bit 3: PGS_CBP_Sat_CB_Vector() returned PGSCBP_W_BELOW_SURFACE; bit 4: PGS_CBP_Sat_CB_Vector() returned PGSCBP_W_BAD_CB_VECTOR; bit 5: PGS_CBP_Sat_CB_Vector() returned PGSCBP_E_BAD_ARRAY_SIZE; bit 6: PGS_CBP_Sat_CB_Vector() returned PGSCBP_E_INVALID_CB_ID; bit 7: PGS_CBP_Sat_CB_Vector() returned PGSMEM_E_NO_MEMORY; bit 8: PGS_CBP_Sat_CB_Vector() returned PGSCBP_E_UNABLE_TO_OPEN_FILE; bit 9: PGS_CBP_Sat_CB_Vector() returned PGSTD_E_BAD_INITIAL_TIME; bit 10: PGS_CBP_Sat_CB_Vector() returned PGSCBP_E_TIME_OUT_OF_RANGE; bit 11: PGS_CBP_Sat_CB_Vector() returned PGSTD_E_SC_TAG_UNKNOWN; bit 12: PGS_CBP_Sat_CB_Vector() returned PGSEPH_E_BAD_EPHEM_FILE_HDR; bit 13: PGS_CBP_Sat_CB_Vector() returned PGSEPH_E_NO_SC_EPHEM_FILE; bit 14: PGS_CBP_Sat_CB_Vector() returned PGS_E_TOOLKIT; bit 15: not used
nadirTAI	64-bit floating-point	None	TAI time at which instrument is nominally looking directly down. (between footprints 15 & 16 for AMSU or between footprints 45 & 46 for AIRS/Vis & HSB) (floating-point elapsed seconds since start of 1993)
sat_lat	64-bit floating-point	None	Satellite geodetic latitude in degrees North (-90.0 ... 90.0)
sat_lon	64-bit floating-point	None	Satellite geodetic longitude in degrees East (-180.0 ... 180.0)
scan_node_type	8-bit integer	None	'A' for ascending, 'D' for descending, 'N' for North-Polar, 'S' for South-Polar
glintlat	32-bit floating-point	None	Solar glint geodetic latitude in degrees North at nadirTAI (-90.0 ... 90.0)
glintlon	32-bit floating-point	None	Solar glint geodetic longitude in degrees East at nadirTAI (-180.0 ... 180.0)
state1	32-bit integer	None	Data state for AMSU-A1: 0:Process, 1:Special, 2:Erroneous, 3:Missing
state2	32-bit integer	None	Data state for AMSU-A2: 0:Process, 1:Special, 2:Erroneous, 3:Missing (AMSU-A2 is AMSU-A channels 1 and 2)
cal_coef_a0	32-bit floating-point	Channel (= 15)	Calibration coefficients to convert raw counts to antenna temperature (K)
cal_coef_a1	32-bit floating-point	Channel (= 15)	Calibration coefficients to convert raw counts to antenna temperature (K/count)
cal_coef_a2	32-bit floating-point	Channel (= 15)	Calibration coefficients to convert raw counts to antenna temperature (K/count**2)

cal_coef_a0_err	32-bit floating-point	Channel (= 15)	Error estimate for cal_coef_a0 (K)
cal_coef_a1_err	32-bit floating-point	Channel (= 15)	Error estimate for cal_coef_a1 (K/count)
cal_coef_a2_err	32-bit floating-point	Channel (= 15)	Error estimate for cal_coef_a2 (K/count**2)
a1_ColdCalPstion	8-bit integer	None	AMSU-A1 Cold Calibration Position 1-4 (Binary 0-3)
a2_ColdCalPstion	8-bit integer	None	AMSU-A2 Cold Calibration Position 1-4 (Binary 0-3) (AMSU-A2 is AMSU-A channels 1 and 2)
a1_PLO_Redundncy	8-bit integer	None	AMSU-A1 PLO Redundancy, 1: default (PLO 2); 0: redundant (PLO 1)
a11_mux_temp_used	8-bit integer	None	AMSU-A1-1 MUX Temperature use flag. (1: used MUX temperature for AMSU-A1 receiver temperature; 0: used RF shelf temperature) (AMSU-A1-1 is AMSU-A channels 6, 7, 9-15)
a11_receiver_temp	32-bit floating-point	None	AMSU-A1-1 receiver temperature used in calibration (MUX temperature or RF shelf temperature as specified by a11_mux_temp_used) (AMSU-A1-1 is AMSU-A channels 6, 7, 9-15) (C)
a11_target_temp	32-bit floating-point	None	AMSU-A1-1 target temperature used in calibration (AMSU-A1-1 is AMSU-A channels 6, 7, 9-15) (C)
a12_mux_temp_used	8-bit integer	None	AMSU-A1-2 MUX Temperature use flag. (1: used MUX temperature for AMSU-A1 receiver temperature; 0: used RF shelf temperature) (AMSU-A1-2 is AMSU-A channels 3, 4, 5, and 8)
a12_receiver_temp	32-bit floating-point	None	AMSU-A1-2 receiver temperature used in calibration (MUX temperature or RF shelf temperature as specified by a12_mux_temp_used) (AMSU-A1-2 is AMSU-A channels 3, 4, 5, and 8) (C)
a12_target_temp	32-bit floating-point	None	AMSU-A1-2 target temperature used in calibration (AMSU-A1-2 is AMSU-A channels 3, 4, 5, and 8) (C)
a2_diplexer_temp_used	8-bit integer	None	AMSU-A2 diplexer Temperature use flag. (1: used diplexer temperature for AMSU-A2 receiver temperature; 0: used RF shelf temperature) (AMSU-A2 is AMSU-A channels 1 and 2)
a2_receiver_temp	32-bit floating-point	None	AMSU-A2 receiver temperature used in calibration (diplexer temperature or RF shelf temperature as specified by a2_mux_temp_used) (AMSU-A2 is AMSU-A channels 1 and 2) (C)
a2_target_temp	32-bit floating-point	None	AMSU-A2 target temperature used in calibration (AMSU-A2 is AMSU-A channels 1 and 2) (C)
qa_scanline	8-bit unsigned integer	None	Scanline bitmap for AMSU-A: Bit 0: Sun glint in this scanline; Bit 1: Coastal crossing in this scanline; Bit 2: Some channels had excessive NeDT estimate; Bit 3: Near sidelobe correction applied
qa_receiver_a11	8-bit unsigned integer	None	Receiver bitmap for AMSU-A1-1 (AMSU-A1-1 is AMSU-A channels 6, 7, 9-15): Bit 0: Calibration was not derived, due to the instrument mode; Bit 1: Calibration was not derived, due to bad or missing PRT values; Bit 2: This scanline was calibrated, but the moon was in the space view; Bit 3: This scanline was calibrated, but there was a space view scan position err; Bit 4: This scanline was calibrated, but there was a blackbody scan position error; Bit 5: This scanline was calibrated, but some PRT values were bad or marginal; Bit 6: This scanline was calibrated, but there was a data gap; Bit 7: Some channels were not calibrated
qa_receiver_a12	8-bit unsigned integer	None	Receiver bitmap for AMSU-A1-2: Same fields as defined for qa_receiver_a11
qa_receiver_a2	8-bit unsigned integer	None	Receiver bitmap for AMSU-A2: Same fields as defined for qa_receiver_a11
qa_channel	8-bit unsigned integer	Channel (= 15)	Channel bitmap for AMSU-A: Bit 0: All space view counts were bad for this channel and scanline; Bit 1: Space view counts were marginal for this channel and scanline; Bit 2: Space view counts could not be smoothed; Bit 3: All blackbody counts were bad for this channel and scanline; Bit 4: Blackbody counts were marginal for this channel and scanline; Bit 5: Blackbody counts could not be smoothed; Bit 6: Unable to calculate calibration coefficients for this scanline, most recent valid coefficients used instead; Bit 7: Excessive NeDT estimated

Size: 21330 bytes (0.0 MB) per 45-scanset granule

## Full Swath Data Fields

These fields appear for every footprint of every scanline in the granule (GeoTrack \* GeoXTrack times)

Name	Type	Extra Dimensions	Explanation
scanang	32-bit floating-point	None	Scanning angle of AMSU-A instrument with respect to the AMSU-A Instrument for this footprint (-180.0 ... 180.0, negative at start of scan, 0 at nadir)
ftptgeoqa	32-bit unsigned integer	None	Footprint Geolocation QA flags: bit 0 (LSB): bad input value; bit 1: PGS_TD_TAItoUTC() returned PGSTD_E_NO_LEAP_SECS; bit 2: PGS_TD_TAItoUTC() returned PGS_E_TOOLKIT; bit 3: PGS_CSC_GetFOV_Pixel() returned PGSCSC_W_MISS_EARTH; bit 4: PGS_CSC_GetFOV_Pixel() returned PGSTD_E_SC_TAG_UNKNOWN; bit 5: PGS_CSC_GetFOV_Pixel() returned PGSCSC_W_ZERO_PIXEL_VECTOR; bit 6: PGS_CSC_GetFOV_Pixel() returned PGSCSC_W_BAD_EPH_FOR_PIXEL; bit 7: PGS_CSC_GetFOV_Pixel() returned PGSCSC_W_INSTRUMENT_OFF_BOARD; bit 8:



			PGS_CSC_GetFOV_Pixel() returned PGSCSC_W_BAD_ACCURACY_FLAG; bit 9: PGS_CSC_GetFOV_Pixel() returned PGSCSC_E_BAD_ARRAY_SIZE; bit 10: PGS_CSC_GetFOV_Pixel() returned PGSCSC_W_DEFAULT_EARTH_MODEL; bit 11: PGS_CSC_GetFOV_Pixel() returned PGSCSC_W_DATA_FILE_MISSING; bit 12: PGS_CSC_GetFOV_Pixel() returned PGSCSC_E_NEG_OR_ZERO_RAD; bit 13: PGS_CSC_GetFOV_Pixel() returned PGSMEM_E_NO_MEMORY; bit 14: PGS_CSC_GetFOV_Pixel() returned PGSTD_E_NO_LEAP_SECS; bit 15: PGS_CSC_GetFOV_Pixel() returned PGSTD_E_TIME_FMT_ERROR; bit 16: PGS_CSC_GetFOV_Pixel() returned PGSTD_E_TIME_VALUE_ERROR; bit 17: PGS_CSC_GetFOV_Pixel() returned PGSCSC_W_PREDICTED_UT1; bit 18: PGS_CSC_GetFOV_Pixel() returned PGSTD_E_NO_UT1_VALUE; bit 19: PGS_CSC_GetFOV_Pixel() returned PGS_E_TOOLKIT; bit 20: PGS_CSC_GetFOV_Pixel() returned PGSEPH_E_BAD_EPHEM_FILE_HDR; bit 21: PGS_CSC_GetFOV_Pixel() returned PGSEPH_E_NO_SC_EPHEM_FILE; bit 22-31: not used
zengeoqa	16-bit unsigned integer	None	Satellite zenith Geolocation QA flags: bit 0 (LSB): (Spacecraft) bad input value; bit 1: PGS_CSC_ZenithAzimuth(S/C) returned PGSCSC_W_BELOW_HORIZON; bit 2: PGS_CSC_ZenithAzimuth(S/C) returned PGSCSC_W_UNDEFINED_AZIMUTH; bit 3: PGS_CSC_ZenithAzimuth(S/C) returned PGSCSC_W_NO_REFRACTION; bit 4: PGS_CSC_ZenithAzimuth(S/C) returned PGSCSC_E_INVALID_VECTAG; bit 5: PGS_CSC_ZenithAzimuth(S/C) returned PGSCSC_E_LOOK_PT_ALTIT_RANGE; bit 6: PGS_CSC_ZenithAzimuth(S/C) returned PGSCSC_E_ZERO_INPUT_VECTOR; bit 7: PGS_CSC_ZenithAzimuth(S/C) returned PGS_E_TOOLKIT; bit 8: (Sun) bad input value; bit 9: (suppressed) PGS_CSC_ZenithAzimuth(Sun) returned PGSCSC_W_BELOW_HORIZON (This is not an error condition - the sun is below the horizon at night); bit 10: PGS_CSC_ZenithAzimuth(Sun) returned PGSCSC_W_UNDEFINED_AZIMUTH; bit 11: PGS_CSC_ZenithAzimuth(Sun) returned PGSCSC_W_NO_REFRACTION; bit 12: PGS_CSC_ZenithAzimuth(Sun) returned PGSCSC_E_INVALID_VECTAG; bit 13: PGS_CSC_ZenithAzimuth(Sun) returned PGSCSC_E_LOOK_PT_ALTIT_RANGE; bit 14: PGS_CSC_ZenithAzimuth(Sun) returned PGSCSC_E_ZERO_INPUT_VECTOR; bit 15: PGS_CSC_ZenithAzimuth(Sun) returned PGS_E_TOOLKIT
demgeoqa	16-bit unsigned integer	None	Digital Elevation Model (DEM) Geolocation QA flags: bit 0 (LSB): bad input value; bit 1: Could not allocate memory; bit 2: Too close to North or South pole. Excluded; bit 3: Layer resolution incompatibility. Excluded; bit 4: Any DEM Routine (elev) returned PGSDM_E_IMPROPER_TAG; bit 5: Any DEM Routine (elev) returned PGSDM_E_CANNOT_ACCESS_DATA; bit 6: Any DEM Routine (land/water) returned PGSDM_E_IMPROPER_TAG; bit 7: Any DEM Routine (land/water) returned PGSDM_E_CANNOT_ACCESS_DATA; bit 8: Reserved for future layers; bit 9: Reserved for future layers; bit 10: PGS_DEM_GetRegion(elev) returned PGSDM_M_FILLVALUE_INCLUDED; bit 11: PGS_DEM_GetRegion(land/water) returned PGSDM_M_FILLVALUE_INCLUDED; bit 12: Reserved for future layers; bit 13: PGS_DEM_GetRegion(all) returned PGSDM_M_MULTIPLE_RESOLUTIONS; bit 14: PGS_CSC_GetFOV_Pixel() returned any 'W' class return code except PGSCSC_W_PREDICTED_UT1; bit 15: PGS_CSC_GetFOV_Pixel() returned any 'E' class return code
satzen	32-bit floating-point	None	Spacecraft zenith angle (0.0 ... 180.0) degrees from zenith (measured relative to the geodetic vertical on the reference (WGS84) spheroid and including corrections outlined in EOS SDP toolkit for normal accuracy.)
satazi	32-bit floating-point	None	Spacecraft azimuth angle (-180.0 ... 180.0) degrees E of N GEO)
solzen	32-bit floating-point	None	Solar zenith angle (0.0 ... 180.0) degrees from zenith (measured relative to the geodetic vertical on the reference (WGS84) spheroid and including corrections outlined in EOS SDP toolkit for normal accuracy.)
solazi	32-bit floating-point	None	Solar azimuth angle (-180.0 ... 180.0) degrees E of N GEO)
sun_glint_distance	16-bit integer	None	Distance (km) from footprint center to location of the sun glint (-9999 for unknown, 30000 for no glint visible because spacecraft is in Earth's shadow)
topog	32-bit floating-point	None	Mean topography in meters above reference ellipsoid
topog_err	32-bit floating-point	None	Error estimate for topog
landFrac	32-bit floating-point	None	Fraction of spot that is land (0.0 ... 1.0)
landFrac_err	32-bit floating-point	None	Error estimate for landFrac
antenna_temp	32-bit floating-point	Channel (= 15)	Raw antenna temperature in Kelvins
brightness_temp	32-bit floating-point	Channel (= 15)	Sidelobe-corrected antenna temperatures in Kelvins
brightness_temp_err	32-bit floating-point	Channel (= 15)	Error in brightness_temp (K)

Size: 305100 bytes (0.3 MB) per 45-scanset granule

**Total File Size (plus storage for dimensions and other HDF-EOS overhead): 394340 bytes (0.4 MB) per 45-scanset granule = 94.6 MB per day**

## Special AIRS Types

Limited Engineering Struct: This type is used for engineering data fields for which there are known "yellow" limits

Field Name	Type	Explanation
min	32-bit floating-point	Minimum value field takes on in granule (not valid when num_in = 0)
max	32-bit floating-point	Maximum value field takes on in granule (not valid when num_in = 0)
mean	32-bit floating-point	Mean of in-range values field takes on in granule (not valid when num_in = 0)
dev	32-bit floating-point	Standard Deviation of in-range values field takes on in granule (not valid when num_in = 0)
num_in	32-bit integer	Count of in-range values field takes on in granule
num_lo	32-bit integer	Count of out-of-range low values field takes on in granule
num_hi	32-bit integer	Count of out-of-range high values field takes on in granule
num_bad	32-bit integer	Count of occasions on which field takes on invalid flag value (-9999) in granule
range_min	32-bit floating-point	Minimum in-range value. Any value less than this is counted in num_lo and is not used in the calculation of mean & dev.
range_max	32-bit floating-point	Maximum in-range value. Any value greater than this is counted in num_hi and is not used in the calculation of mean & dev.
missing	8-bit integer	Missing limits flags. Bit 0 (LSB) is 1 when yellow low (range_min) limit is missing; Bit 1 is high when yellow high (range_max) limit is missing; other bits unused, set to 0.
max_track	32-bit integer	GeoTrack index (counting from 1) where max was found
max_xtrack	32-bit integer	GeoXTrack index (counting from 1) where max was found
min_track	32-bit integer	GeoTrack index (counting from 1) where min was found
min_xtrack	32-bit integer	GeoXTrack index (counting from 1) where min was found

Unlimited Engineering Struct: This type is used for engineering data fields for which there are NOT known "yellow" limits

Field Name	Type	Explanation
min	32-bit floating-point	Minimum value field takes on in granule (not valid when num = 0)
max	32-bit floating-point	Maximum value field takes on in granule (not valid when num = 0)
mean	32-bit floating-point	Mean of values field takes on in granule (not valid when num = 0)
dev	32-bit floating-point	Standard Deviation of values field takes on in granule (not valid when num = 0)
num	32-bit integer	Count of occurrences of field in granule (not including those counted in num_bad)
num_bad	32-bit integer	Count of occasions on which field takes on invalid flag value (-9999) in granule
max_track	32-bit integer	GeoTrack index (counting from 1) where max was found
max_xtrack	32-bit integer	GeoXTrack index (counting from 1) where max was found
min_track	32-bit integer	GeoTrack index (counting from 1) where min was found
min_xtrack	32-bit integer	GeoXTrack index (counting from 1) where min was found

## A-6. L1B HSB Science Interface Specification

Interface Specification Version 3.0.4.0  
2003-05-19

ESDT ShortName = "AIRHBRAD"

Swath Name = "L1B\_HSB"

Level = "level1B"

# Footprints = 90

# scanlines per scanset = 3

### Dimensions

These fields define all dimensions that can be used for HDF-EOS swath fields.

The names "GeoTrack" and "GeoXTrack" have a special meaning for this document: "Cross-Track" data fields have a hidden dimension of "GeoXTrack"; "Along-Track" data fields have a hidden dimension of "GeoTrack"; "Full Swath Data Fields have hidden dimensions of both "GeoTrack" and "GeoXTrack".

Name	Value	Explanation
GeoXTrack	90	Dimension across track for footprint positions. Same as number of footprints per scanline. -- starting at the left and increasing towards the right as you look along the satellite's path
GeoTrack	# of scan lines in swath	Dimension along track for footprint positions. Same as number of scanlines in granule. Parallel to the satellite's path, increasing with time. (Nominally 45 for Level-2, AMSU-A, and AIRS/Vis low-rate engineering; 135 for AIRS/Vis and HSB high-rate quantities)
Channel	5	Dimension of channel array (Channel 1: Deleted 89.0 GHz channel: always invalid; Ch 2: 150.0 GHz; Ch 3: f0 +/- 1.0 GHz; Ch 4: f0 +/- 3.0 GHz; Ch 5: f0 +/- 7.0 GHz (f0 = 183.31 GHz))
CalXTrack	8	Dimension "across" track for calibration footprint positions. Same as number of calibration footprints per scanline. (NUM_FOOTPRINTS_HSB_CALIB) (Footprints are ordered: 1-4: spaceviews; 5-8: blackbody radiometric calibration source)
SpaceXTrack	4	Dimension "across" track for spaceview calibration footprint positions in order of observation time. (NUM_FOOTPRINTS_HSB_SPACE)
BBXTrack	4	Dimension "across" track for blackbody calibration footprint positions in order of observation time. (NUM_FOOTPRINTS_HSB_BB)
WarmPRT	7	Number of PRTs measuring warm target

### Geolocation Fields

These fields appear for every footprint (GeoTrack \* GeoXTrack times) and correspond to footprint center coordinates and "shutter" time.

Name	Explanation
Latitude	Footprint boresight geodetic Latitude in degrees North (-90.0 ... 90.0)
Longitude	Footprint boresight geodetic Longitude in degrees East (-180.0 ... 180.0)
Time	Footprint "shutter" TAI Time: floating-point elapsed seconds since Jan 1, 1993

Size: 291600 bytes (0.3 MB) per 45-scanset granule

### Attributes

These fields appear only once per granule

Name	Type	Extra Dimensions	Explanation
processing_level	string of 8-bit characters	None	Zero-terminated character string denoting processing level ("level1B")
instrument	string of 8-bit characters	None	Zero-terminated character string denoting instrument ("HSB")
DayNightFlag	string of 8-bit characters	None	Zero-terminated character string denoting granule as day and/or night: (Always "Day", "Night", or "Both")
AutomaticQAFlag	string of 8-bit characters	None	Zero-terminated character string denoting granule data quality: (Always "Passed", "Failed", or "Suspect")
NumTotalData	32-bit integer	None	Total number of expected channels * scene FOVs
NumProcessData	32-bit integer	None	Number of channels * scene FOVs which are present and can be processed routinely (state = 0)
NumSpecialData	32-bit integer	None	Number of channels * scene FOVs which are present and can be processed only as a special test (state = 1)

NumBadData	32-bit integer	None	Number of channels * scene FOVs which are present but cannot be processed (state = 2)
NumMissingData	32-bit integer	None	Number of expected channels * scene FOVs which are not present (state = 3)
NumLandSurface	32-bit integer	None	Number of scene footprints for which the surface is more than 90% land
NumOceanSurface	32-bit integer	None	Number of scene footprints for which the surface is less than 10% land
node_type	string of 8-bit characters	None	Zero-terminated character string denoting whether granule is ascending, descending, or pole-crossing: ("Ascending" and "Descending" for entirely ascending or entirely descending granules, or "NorthPole" or "SouthPole" for pole-crossing granules)
start_year	32-bit integer	None	Year in which granule started, UTC (e.g. 1999)
start_month	32-bit integer	None	Month in which granule started, UTC (1 ... 12)
start_day	32-bit integer	None	Day of month in which granule started, UTC (1 ... 31)
start_hour	32-bit integer	None	Hour of day in which granule started, UTC (0 ... 23)
start_minute	32-bit integer	None	Minute of hour in which granule started, UTC (0 ... 59)
start_sec	32-bit floating-point	None	Second of minute in which granule started, UTC (0.0 ... 59.0)
start_orbit	32-bit integer	None	Orbit number of mission in which granule started
end_orbit	32-bit integer	None	Orbit number of mission in which granule ended
orbit_path	32-bit integer	None	Orbit path of start orbit (1 ... 233 as defined by EOS project)
start_orbit_row	32-bit integer	None	Orbit row at start of granule (1 ... 248 as defined by EOS project)
end_orbit_row	32-bit integer	None	Orbit row at end of granule (1 ... 248 as defined by EOS project)
granule_number	32-bit integer	None	Number of granule within day (1 ... 240)
num_scansets	32-bit integer	None	Number of scansets in granule (1 ... 45)
num_scanlines	32-bit integer	None	Number of scanlines in granule (3 * num_scansets)
start_Latitude	64-bit floating-point	None	Geodetic Latitude of spacecraft at start of granule in degrees North (-90.0 ... 90.0)
start_Longitude	64-bit floating-point	None	Geodetic Longitude of spacecraft at start of granule in degrees East (-180.0 ... 180.0)
start_Time	64-bit floating-point	None	TAI Time at start of granule (floating-point elapsed seconds since start of 1993)
end_Latitude	64-bit floating-point	None	Geodetic Latitude of spacecraft at end of granule in degrees North (-90.0 ... 90.0)
end_Longitude	64-bit floating-point	None	Geodetic Longitude of spacecraft at end of granule in degrees East (-180.0 ... 180.0)
end_Time	64-bit floating-point	None	TAI Time at end of granule (floating-point elapsed seconds since start of 1993)
eq_x_longitude	32-bit floating-point	None	Longitude of spacecraft at southward equator crossing nearest granule start in degrees East (-180.0 ... 180.0)
eq_x_tai	64-bit floating-point	None	Time of eq_x_longitude in TAI units (floating-point elapsed seconds since start of 1993)
orbitgeoqa	32-bit unsigned integer	None	Orbit Geolocation QA: bit 0 (LSB): bad input value (last scanline); bit 1: bad input value (first scanline); bit 2: PGS_EPH_GetEphMet() returned PGSEPH_E_NO_SC_EPHEM_FILE; bit 3: PGS_EPH_GetEphMet() returned PGSEPH_E_BAD_ARRAY_SIZE; bit 4: PGS_EPH_GetEphMet() returned PGSTD_E_TIME_FMT_ERROR; bit 5: PGS_EPH_GetEphMet() returned PGSTD_E_TIME_VALUE_ERROR; bit 6: PGS_EPH_GetEphMet() returned PGSTD_E_SC_TAG_UNKNOWN; bit 7: PGS_EPH_GetEphMet() returned PGS_E_TOOLKIT; bit 8: PGS_TD_UTCtoTAI() returned PGSTD_E_NO_LEAP_SECS; bit 9: PGS_TD_UTCtoTAI() returned PGSTD_E_TIME_FMT_ERROR; bit 10: PGS_TD_UTCtoTAI() returned PGSTD_E_TIME_VALUE_ERROR; bit 11: PGS_TD_UTCtoTAI() returned PGS_E_TOOLKIT; bit 12: PGS_CSC_DayNight() returned PGSTD_E_NO_LEAP_SECS; bit 13: PGS_CSC_DayNight() returned PGSCSC_E_INVALID_LIMITTAG; bit 14: PGS_CSC_DayNight() returned PGSCSC_E_BAD_ARRAY_SIZE; bit 15: PGS_CSC_DayNight() returned PGSCSC_W_ERROR_IN_DAYNIGHT; bit 16: PGS_CSC_DayNight() returned PGSCSC_W_BAD_TRANSFORM_VALUE; bit 17: PGS_CSC_DayNight() returned PGSCSC_W_BELOW_HORIZON; bit 18: PGS_CSC_DayNight() returned PGSCSC_W_PREDICTED_UT1; bit 19: PGS_CSC_DayNight() returned PGSTD_E_NO_UT1_VALUE; bit 20: PGS_CSC_DayNight() returned PGSTD_E_BAD_INITIAL_TIME; bit 21: PGS_CSC_DayNight() returned PGSCBP_E_TIME_OUT_OF_RANGE; bit 22: PGS_CSC_DayNight() returned PGSCBP_E_UNABLE_TO_OPEN_FILE; bit 23: PGS_CSC_DayNight() returned PGSMEM_E_NO_MEMORY; bit 24: PGS_CSC_DayNight() returned PGS_E_TOOLKIT; bit 25-31: not used
num_satgeoqa	16-bit integer	None	Number of scans with problems in satgeoqa

num_glintgeoqa	16-bit integer	None	Number of scans with problems in glintgeoqa
num_moongeoqa	16-bit integer	None	Number of scans with problems in moongeoqa
num_ftptgeoqa	16-bit integer	None	Number of footprints with problems in ftptgeoqa
num_zengeoqa	16-bit integer	None	Number of footprints with problems in zengeoqa
num_demgeoqa	16-bit integer	None	Number of footprints with problems in demgeoqa
num_fpe	16-bit integer	None	Number of floating point errors
LonGranuleCen	16-bit integer	None	Geodetic Longitude of the center of the granule in degrees East (-180 ... 180)
LatGranuleCen	16-bit integer	None	Geodetic Latitude of the center of the granule in degrees North (-90 ... 90)
LocTimeGranuleCen	16-bit integer	None	Local solar time at the center of the granule in minutes past midnight (0 ... 1439)
center_freq	32-bit floating-point	Channel (= 5)	Channel Center frequency (GHz)
IF_offset_1	32-bit floating-point	Channel (= 5)	Offset of first intermediate frequency stage (MHz) (zero for no mixing)
IF_offset_2	32-bit floating-point	Channel (= 5)	Offset of second intermediate frequency stage (MHz) (zero for no second mixing)
bandwidth	32-bit floating-point	Channel (= 5)	Bandwidth of sum of 1, 2, or 4 channels (MHz)
num_scanlines_not_norm_mode	32-bit integer	None	Number of scanlines not in Process state
num_calibrated_scanlines	32-bit integer	Channel (= 5)	Number of scanlines that had calibration coefs applied
num_missing_scanlines	32-bit integer	None	Number of scanlines with state = missing
num_data_gaps	32-bit integer	None	Number of blocks of scanlines where State is not Process
num_instr_mode_changes	32-bit integer	None	Number of operational instrument mode changes
num_scanlines_rec_cal_prob	32-bit integer	None	Number of scanlines with non-zero qa_receiver
num_scanlines_ch_cal_problems	32-bit integer	Channel (= 5)	Number of scanlines with non-zero qa_channel
num_scanlines_sig_coast_xing	32-bit integer	None	Number of scanlines with qa_scanline coast crossing bit set
num_scanlines_sig_sun_glint	32-bit integer	None	Number of scanlines with qa_scanline sun glint bit set
MoonInViewMWCount	32-bit integer	None	Number of scanlines in granule with the moon in the HSB space view
QA_unfiltered_scene_count	Unlimited Engineering Struct (see below)	GeoXTrack (= 90) * Channel (= 5)	Per footprint position raw scene count summary QA
QA_unfiltered_BB_count	Unlimited Engineering Struct (see below)	BBXTrack (= 4) * Channel (= 5)	Per BB footprint position raw warm count summary QA (unfiltered)
QA_unfiltered_space_count	Unlimited Engineering Struct (see below)	SpaceXTrack (= 4) * Channel (= 5)	Per space footprint position raw cold count summary QA (unfiltered)
QA_bb_PRT	Limited Engineering Struct (see below)	None	Blackbody PRT temperature summary QA (C)
QA_rec_PRT	Limited Engineering Struct (see below)	None	Receiver PRT temperature summary QA (C)
QA_cal_coef_a0	Unlimited Engineering Struct (see below)	Channel (= 5)	Calibration coefficient a0 summary QA (K)
QA_cal_coef_a1	Unlimited Engineering Struct (see below)	Channel (= 5)	Calibration coefficient a1 summary QA (K/count)
QA_cal_coef_a2	Unlimited Engineering Struct (see below)	Channel (= 5)	Calibration coefficient a2 summary QA (K/count**2)
QA_bb_raw_noise_counts	Unlimited Engineering Struct (see below)	Channel (= 5)	Summary QA on differences between warm cal counts

	below)		
QA_sv_raw_noise_counts	Unlimited Engineering Struct (see below)	Channel (= 5)	Summary QA on differences between cold cal counts
QA_NeDT	Unlimited Engineering Struct (see below)	Channel (= 5)	Summary QA on gain * differences between warm cal counts (K)
QA_NeDT2NomRatio	Unlimited Engineering Struct (see below)	Channel (= 5)	Summary QA on gain * differences between warm cal counts over nominal NeDT (unitless)
granules_present	string of 8-bit characters	None	Zero-terminated character string denoting which adjacent granules were available for smoothing ("All" for both previous & next, "Prev" for previous but not next, "Next" for next but not previous, "None" for neither previous nor next)

Size: 29886 bytes (0.0 MB) per granule

## Along-Track Data Fields

These fields appear once per scanline (GeoTrack times)

Name	Type	Extra Dimensions	Explanation
satheight	32-bit floating-point	None	Satellite altitude at nadirTAI in km above reference ellipsoid (e.g. 725.2)
satroll	32-bit floating-point	None	Satellite attitude roll angle at nadirTAI (-180.0 ... 180.0 angle about the +x (roll) ORB axis, +x axis is positively oriented in the direction of orbital flight completing an orthogonal triad with y and z.)
satpitch	32-bit floating-point	None	Satellite attitude pitch angle at nadirTAI (-180.0 ... 180.0 angle about +y (pitch) ORB axis. +y axis is oriented normal to the orbit plane with the positive sense opposite to that of the orbit's angular momentum vector H.)
satyaw	32-bit floating-point	None	Satellite attitude yaw angle at nadirTAI (-180.0 ... 180.0 angle about +z (yaw) axis. +z axis is positively oriented earthward parallel to the satellite radius vector R from the spacecraft center of mass to the center of the Earth.)
satgeoqa	32-bit unsigned integer	None	Satellite Geolocation QA flags: bit 0 (LSB): bad input value; bit 1: PGS_TD_TAtoUTC() returned PGSTD_E_NO_LEAP_SECS; bit 2: PGS_TD_TAtoUTC() returned PGS_E_TOOLKIT; bit 3: PGS_EPH_EphemAttit() returned PGSEPH_W_BAD_EPHEM_VALUE; bit 4: PGS_EPH_EphemAttit() returned PGSEPH_E_BAD_EPHEM_FILE_HDR; bit 5: PGS_EPH_EphemAttit() returned PGSEPH_E_NO_SC_EPHEM_FILE; bit 6: PGS_EPH_EphemAttit() returned PGSEPH_E_NO_DATA_REQUESTED; bit 7: PGS_EPH_EphemAttit() returned PGSTD_E_SC_TAG_UNKNOWN; bit 8: PGS_EPH_EphemAttit() returned PGSEPH_E_BAD_ARRAY_SIZE; bit 9: PGS_EPH_EphemAttit() returned PGSTD_E_TIME_FMT_ERROR; bit 10: PGS_EPH_EphemAttit() returned PGSTD_E_TIME_VALUE_ERROR; bit 11: PGS_EPH_EphemAttit() returned PGSTD_E_NO_LEAP_SECS; bit 12: PGS_EPH_EphemAttit() returned PGS_E_TOOLKIT; bit 13: PGS_CSC_ECtoECR() returned PGSCSC_W_BAD_TRANSFORM_VALUE; bit 14: PGS_CSC_ECtoECR() returned PGSCSC_E_BAD_ARRAY_SIZE; bit 15: PGS_CSC_ECtoECR() returned PGSTD_E_NO_LEAP_SECS; bit 16: PGS_CSC_ECtoECR() returned PGSTD_E_TIME_FMT_ERROR; bit 17: PGS_CSC_ECtoECR() returned PGSTD_E_TIME_VALUE_ERROR; bit 18: unused (set to zero); bit 19: PGS_CSC_ECtoECR() returned PGSTD_E_NO_UT1_VALUE; bit 20: PGS_CSC_ECtoECR() returned PGS_E_TOOLKIT; bit 21: PGS_CSC_ECRtoGEO() returned PGSCSC_W_TOO_MANY_ITERS; bit 22: PGS_CSC_ECRtoGEO() returned PGSCSC_W_INVALID_ALTITUDE; bit 23: PGS_CSC_ECRtoGEO() returned PGSCSC_W_SPHERE_BODY; bit 24: PGS_CSC_ECRtoGEO() returned PGSCSC_W_LARGE_FLATTENING; bit 25: PGS_CSC_ECRtoGEO() returned PGSCSC_W_DEFAULT_EARTH_MODEL; bit 26: PGS_CSC_ECRtoGEO() returned PGSCSC_E_BAD_EARTH_MODEL; bit 27: PGS_CSC_ECRtoGEO() returned PGS_E_TOOLKIT; bit 28-31: not used
glintgeoqa	16-bit unsigned integer	None	Glint Geolocation QA flags: bit 0 (LSB): bad input value; bit 1: glint location in Earth's shadow; bit 2: glint calculation not converging; bit 3: glint location sun vs. satellite zenith mismatch; bit 4: glint location sun vs. satellite azimuth mismatch; bit 5: bad glint location; bit 6: PGS_CSC_ZenithAzimuth() returned any 'W' class return code; bit 7: PGS_CSC_ZenithAzimuth() returned any 'E' class return code; bit 8: PGS_CBP_Earth_CB_Vector() returned any 'W' class return code; bit 9: PGS_CBP_Earth_CB_Vector() returned any 'E' class return code; bit 10: PGS_CSC_ECtoECR() returned any 'W' class return code except PGSCSC_W_PREDICTED_UT1 (for Glint); bit 11: PGS_CSC_ECtoECR() returned any 'E' class return code (for Glint); bit 12: PGS_CSC_ECRtoGEO() returned any 'W' class return code (for Glint); bit 13: PGS_CSC_ECRtoGEO() returned any 'E' class return code (for Glint); bit 14: PGS_CSC_ECtoECR() returned any 'W' class return code except PGSCSC_W_PREDICTED_UT1; bit 15: PGS_CSC_ECtoECR() returned any 'E' class return code
moongeoqa	16-bit unsigned integer	None	Moon Geolocation QA flags: bit 0 (LSB): bad input value; bit 1: PGS_TD_TAtoUTC() returned PGSTD_E_NO_LEAP_SECS; bit 2: PGS_TD_TAtoUTC() returned PGS_E_TOOLKIT; bit 3: PGS_CBP_Sat_CB_Vector() returned PGSCSC_W_BELOW_SURFACE; bit 4: PGS_CBP_Sat_CB_Vector() returned

			PGSCBP_W_BAD_CB_VECTOR; bit 5: PGS_CBP_Sat_CB_Vector() returned PGSCBP_E_BAD_ARRAY_SIZE; bit 6: PGS_CBP_Sat_CB_Vector() returned PGSCBP_E_INVALID_CB_ID; bit 7: PGS_CBP_Sat_CB_Vector() returned PGSMEM_E_NO_MEMORY; bit 8: PGS_CBP_Sat_CB_Vector() returned PGSCBP_E_UNABLE_TO_OPEN_FILE; bit 9: PGS_CBP_Sat_CB_Vector() returned PGSTD_E_BAD_INITIAL_TIME; bit 10: PGS_CBP_Sat_CB_Vector() returned PGSCBP_E_TIME_OUT_OF_RANGE; bit 11: PGS_CBP_Sat_CB_Vector() returned PGSTD_E_SC_TAG_UNKNOWN; bit 12: PGS_CBP_Sat_CB_Vector() returned PGSEPH_E_BAD_EPHEM_FILE_HDR; bit 13: PGS_CBP_Sat_CB_Vector() returned PGSEPH_E_NO_SC_EPHEM_FILE; bit 14: PGS_CBP_Sat_CB_Vector() returned PGS_E_TOOLKIT; bit 15: not used
nadirTAI	64-bit floating-point	None	TAI time at which instrument is nominally looking directly down. (between footprints 15 & 16 for AMSU or between footprints 45 & 46 for AIRS/Vis & HSB) (floating-point elapsed seconds since start of 1993)
sat_lat	64-bit floating-point	None	Satellite geodetic latitude in degrees North (-90.0 ... 90.0)
sat_lon	64-bit floating-point	None	Satellite geodetic longitude in degrees East (-180.0 ... 180.0)
scan_node_type	8-bit integer	None	'A' for ascending, 'D' for descending, 'N' for North-Polar, 'S' for South-Polar
glintlat	32-bit floating-point	None	Solar glint geodetic latitude in degrees North at nadirTAI (-90.0 ... 90.0)
glintlon	32-bit floating-point	None	Solar glint geodetic longitude in degrees East at nadirTAI (-180.0 ... 180.0)
state	32-bit integer	None	Data state: 0:Process, 1:Special, 2:Erroneous, 3:Missing
cal_coef_a0	32-bit floating-point	Channel (= 5)	Calibration coefficients to convert raw counts to antenna temperature (K)
cal_coef_a1	32-bit floating-point	Channel (= 5)	Calibration coefficients to convert raw counts to antenna temperature (K/count)
cal_coef_a2	32-bit floating-point	Channel (= 5)	Calibration coefficients to convert raw counts to antenna temperature (K/count**2)
cal_coef_a0_err	32-bit floating-point	Channel (= 5)	Error estimate for cal_coef_a0 (K)
cal_coef_a1_err	32-bit floating-point	Channel (= 5)	Error estimate for cal_coef_a1 (K/count)
cal_coef_a2_err	32-bit floating-point	Channel (= 5)	Error estimate for cal_coef_a2 (K/count**2)
SpacViewSelct	8-bit integer	None	Space View Selected
mixer_17_temp_used	8-bit integer	None	Mixer 17 Temperature use flag. (1: used mixer 17 temperature for receiver temperature; 0: used mixer 18/19/20 temperature)
receiver_temp	32-bit floating-point	None	Receiver temperature used in calibration (mixer 17 temperature or mixer 18/19/20 temperature as specified by mixer_17_temp_used) (C)
target_temp	32-bit floating-point	None	HSB target temperature used in calibration (C)
qa_scanline	8-bit unsigned integer	None	Scanline bitmap for HSB: Bit 0: Sun glint in this scanline; Bit 1: Coastal crossing in this scanline; Bit 2: Some channels had excessive NeDT estimate; Bit 3: Near sidelobe correction applied
qa_receiver	8-bit unsigned integer	None	Receiver bitmap for HSB: Bit 0: Calibration was not derived, due to the instrument mode; Bit 1: Calibration was not derived, due to bad or missing PRT values; Bit 2: This scanline was calibrated, but the moon was in the space view; Bit 3: This scanline was calibrated, but there was a space view scan position err; Bit 4: This scanline was calibrated, but there was a blackbody scan position error; Bit 5: This scanline was calibrated, but some PRT values were bad or marginal; Bit 6: This scanline was calibrated, but there was a data gap; Bit 7: Some channels were not calibrated
qa_channel	8-bit unsigned integer	Channel (= 5)	Channel bitmap for HSB: Bit 0: All space view counts were bad for this channel and scanline; Bit 1: Space view counts were marginal for this channel and scanline; Bit 2: Space view counts could not be smoothed; Bit 3: All blackbody counts were bad for this channel and scanline; Bit 4: Blackbody counts were marginal for this channel and scanline; Bit 5: Blackbody counts could not be smoothed; Bit 6: Most recent calibration coefficients used; Bit 7: Excessive NeDT estimated

Size: 26730 bytes (0.0 MB) per 45-scanset granule

## Full Swath Data Fields

These fields appear for every footprint of every scanline in the granule (GeoTrack \* GeoXTrack times)

Name	Type	Extra Dimensions	Explanation
scanang	32-bit floating-point	None	Scanning angle of HSB instrument with respect to the HSB instrument for this footprint (-180.0 ... 180.0, negative at start of scan, 0 at nadir)
ftptgeoqa	32-bit unsigned	None	Footprint Geolocation QA flags: bit 0 (LSB): bad input value; bit 1: PGS_TD_TAItoUTC() returned PGSTD_E_NO_I_FAP_SECS; bit 2: PGS_TD_TAItoUTC() returned PGS_E_TOOLKIT



	integer		bit 3: PGS_CSC_GetFOV_Pixel() returned PGSCSC_W_MISS_EARTH; bit 4: PGS_CSC_GetFOV_Pixel() returned PGSTD_E_SC_TAG_UNKNOWN; bit 5: PGS_CSC_GetFOV_Pixel() returned PGSCSC_W_ZERO_PIXEL_VECTOR; bit 6: PGS_CSC_GetFOV_Pixel() returned PGSCSC_W_BAD_EPH_FOR_PIXEL; bit 7: PGS_CSC_GetFOV_Pixel() returned PGSCSC_W_INSTRUMENT_OFF_BOARD; bit 8: PGS_CSC_GetFOV_Pixel() returned PGSCSC_W_BAD_ACCURACY_FLAG; bit 9: PGS_CSC_GetFOV_Pixel() returned PGSCSC_E_BAD_ARRAY_SIZE; bit 10: PGS_CSC_GetFOV_Pixel() returned PGSCSC_W_DEFAULT_EARTH_MODEL; bit 11: PGS_CSC_GetFOV_Pixel() returned PGSCSC_W_DATA_FILE_MISSING; bit 12: PGS_CSC_GetFOV_Pixel() returned PGSCSC_E_NEG_OR_ZERO_RAD; bit 13: PGS_CSC_GetFOV_Pixel() returned PGSMEM_E_NO_MEMORY; bit 14: PGS_CSC_GetFOV_Pixel() returned PGSTD_E_NO_LEAP_SECS; bit 15: PGS_CSC_GetFOV_Pixel() returned PGSTD_E_TIME_FMT_ERROR; bit 16: PGS_CSC_GetFOV_Pixel() returned PGSTD_E_TIME_VALUE_ERROR; bit 17: PGS_CSC_GetFOV_Pixel() returned PGSCSC_W_PREDICTED_UT1; bit 18: PGS_CSC_GetFOV_Pixel() returned PGSTD_E_NO_UT1_VALUE; bit 19: PGS_CSC_GetFOV_Pixel() returned PGS_E_TOOLKIT; bit 20: PGS_CSC_GetFOV_Pixel() returned PGSEPH_E_BAD_EPHEM_FILE_HDR; bit 21: PGS_CSC_GetFOV_Pixel() returned PGSEPH_E_NO_SC_EPHEM_FILE; bit 22-31: not used
zengeoqa	16-bit unsigned integer	None	Satellite zenith Geolocation QA flags: bit 0 (LSB): (Spacecraft) bad input value; bit 1: PGS_CSC_ZenithAzimuth(S/C) returned PGSCSC_W_BELOW_HORIZON; bit 2: PGS_CSC_ZenithAzimuth(S/C) returned PGSCSC_W_UNDEFINED_AZIMUTH; bit 3: PGS_CSC_ZenithAzimuth(S/C) returned PGSCSC_W_NO_REFRACTION; bit 4: PGS_CSC_ZenithAzimuth(S/C) returned PGSCSC_E_INVALID_VECTAG; bit 5: PGS_CSC_ZenithAzimuth(S/C) returned PGSCSC_E_LOOK_PT_ALITIT_RANGE; bit 6: PGS_CSC_ZenithAzimuth(S/C) returned PGSCSC_E_ZERO_INPUT_VECTOR; bit 7: PGS_CSC_ZenithAzimuth(S/C) returned PGS_E_TOOLKIT; bit 8: (Sun) bad input value; bit 9: (suppressed) PGS_CSC_ZenithAzimuth(Sun) returned PGSCSC_W_BELOW_HORIZON (This is not an error condition - the sun is below the horizon at night); bit 10: PGS_CSC_ZenithAzimuth(Sun) returned PGSCSC_W_UNDEFINED_AZIMUTH; bit 11: PGS_CSC_ZenithAzimuth(Sun) returned PGSCSC_W_NO_REFRACTION; bit 12: PGS_CSC_ZenithAzimuth(Sun) returned PGSCSC_E_INVALID_VECTAG; bit 13: PGS_CSC_ZenithAzimuth(Sun) returned PGSCSC_E_LOOK_PT_ALITIT_RANGE; bit 14: PGS_CSC_ZenithAzimuth(Sun) returned PGSCSC_E_ZERO_INPUT_VECTOR; bit 15: PGS_CSC_ZenithAzimuth(Sun) returned PGS_E_TOOLKIT
demgeoqa	16-bit unsigned integer	None	Digital Elevation Model (DEM) Geolocation QA flags: bit 0 (LSB): bad input value; bit 1: Could not allocate memory; bit 2: Too close to North or South pole. Excluded; bit 3: Layer resolution incompatibility. Excluded; bit 4: Any DEM Routine (elev) returned PGSDDEM_E_IMPROPER_TAG; bit 5: Any DEM Routine (elev) returned PGSDDEM_E_CANNOT_ACCESS_DATA; bit 6: Any DEM Routine (land/water) returned PGSDDEM_E_IMPROPER_TAG; bit 7: Any DEM Routine (land/water) returned PGSDDEM_E_CANNOT_ACCESS_DATA; bit 8: Reserved for future layers; bit 9: Reserved for future layers; bit 10: PGS_DEM_GetRegion(elev) returned PGSDDEM_M_FILLVALUE_INCLUDED; bit 11: PGS_DEM_GetRegion(land/water) returned PGSDDEM_M_FILLVALUE_INCLUDED; bit 12: Reserved for future layers; bit 13: PGS_DEM_GetRegion(all) returned PGSDDEM_M_MULTIPLE_RESOLUTIONS; bit 14: PGS_CSC_GetFOV_Pixel() returned any 'W' class return code except PGSCSC_W_PREDICTED_UT1; bit 15: PGS_CSC_GetFOV_Pixel() returned any 'E' class return code
satzen	32-bit floating-point	None	Spacecraft zenith angle (0.0 ... 180.0) degrees from zenith (measured relative to the geodetic vertical on the reference (WGS84) spheroid and including corrections outlined in EOS SDP toolkit for normal accuracy.)
satazi	32-bit floating-point	None	Spacecraft azimuth angle (-180.0 ... 180.0) degrees E of N GEO)
solzen	32-bit floating-point	None	Solar zenith angle (0.0 ... 180.0) degrees from zenith (measured relative to the geodetic vertical on the reference (WGS84) spheroid and including corrections outlined in EOS SDP toolkit for normal accuracy.)
solazi	32-bit floating-point	None	Solar azimuth angle (-180.0 ... 180.0) degrees E of N GEO)
sun_glint_distance	16-bit integer	None	Distance (km) from footprint center to location of the sun glint (-9999 for unknown, 30000 for no glint visible because spacecraft is in Earth's shadow)
topog	32-bit floating-point	None	Mean topography in meters above reference ellipsoid
topog_err	32-bit floating-point	None	Error estimate for topog
landFrac	32-bit floating-point	None	Fraction of spot that is land (0.0 ... 1.0)
landFrac_err	32-bit floating-point	None	Error estimate for landFrac
antenna_temp	32-bit floating-point	Channel (= 5)	Raw antenna temperature in Kelvins
brightness_temp	32-bit floating-point	Channel (= 5)	Sidelobe-corrected antenna temperatures in Kelvins
brightness_temp_err	32-bit floating-point	Channel (= 5)	Error in brightness_temp (K)

Size: 1287900 bytes (1.3 MB) per 45-scanset granule



**Total File Size (plus storage for dimensions and other HDF-EOS overhead):  
1636116 bytes (1.6 MB) per 45-scanset granule = 392.7 MB per day**

## Special AIRS Types

Limited Engineering Struct: This type is used for engineering data fields for which there are known "yellow" limits

Field Name	Type	Explanation
min	32-bit floating-point	Minimum value field takes on in granule (not valid when num_in = 0)
max	32-bit floating-point	Maximum value field takes on in granule (not valid when num_in = 0)
mean	32-bit floating-point	Mean of in-range values field takes on in granule (not valid when num_in = 0)
dev	32-bit floating-point	Standard Deviation of in-range values field takes on in granule (not valid when num_in = 0)
num_in	32-bit integer	Count of in-range values field takes on in granule
num_lo	32-bit integer	Count of out-of-range low values field takes on in granule
num_hi	32-bit integer	Count of out-of-range high values field takes on in granule
num_bad	32-bit integer	Count of occasions on which field takes on invalid flag value (-9999) in granule
range_min	32-bit floating-point	Minimum in-range value. Any value less than this is counted in num_lo and is not used in the calculation of mean & dev.
range_max	32-bit floating-point	Maximum in-range value. Any value greater than this is counted in num_hi and is not used in the calculation of mean & dev.
missing	8-bit integer	Missing limits flags. Bit 0 (LSB) is 1 when yellow low (range_min) limit is missing; Bit 1 is high when yellow high (range_max) limit is missing; other bits unused, set to 0.
max_track	32-bit integer	GeoTrack index (counting from 1) where max was found
max_xtrack	32-bit integer	GeoXTrack index (counting from 1) where max was found
min_track	32-bit integer	GeoTrack index (counting from 1) where min was found
min_xtrack	32-bit integer	GeoXTrack index (counting from 1) where min was found

Unlimited Engineering Struct: This type is used for engineering data fields for which there are NOT known "yellow" limits

Field Name	Type	Explanation
min	32-bit floating-point	Minimum value field takes on in granule (not valid when num = 0)
max	32-bit floating-point	Maximum value field takes on in granule (not valid when num = 0)
mean	32-bit floating-point	Mean of values field takes on in granule (not valid when num = 0)
dev	32-bit floating-point	Standard Deviation of values field takes on in granule (not valid when num = 0)
num	32-bit integer	Count of occurrences of field in granule (not including those counted in num_bad)
num_bad	32-bit integer	Count of occasions on which field takes on invalid flag value (-9999) in granule
max_track	32-bit integer	GeoTrack index (counting from 1) where max was found
max_xtrack	32-bit integer	GeoXTrack index (counting from 1) where max was found
min_track	32-bit integer	GeoTrack index (counting from 1) where min was found
min_xtrack	32-bit integer	GeoXTrack index (counting from 1) where min was found

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## A-7. L2 Standard Atmospheric/Surface Product Interface Specification

Interface Specification Version 3.0.4.0  
2003-05-19

ESDT ShortName = "AIRX2RET"

Swath Name = "L2\_Standard\_atmospheric&surface\_product"

Level = "level2"

# Footprints = 30

# scanlines per scanset = 1

### Dimensions

These fields define all dimensions that can be used for HDF-EOS swath fields.

The names "GeoTrack" and "GeoXTrack" have a special meaning for this document: "Cross-Track" data fields have a hidden dimension of "GeoXTrack"; "Along-Track" data fields have a hidden dimension of "GeoTrack"; "Full Swath Data Fields have hidden dimensions of both "GeoTrack" and "GeoXTrack".

Name	Value	Explanation
GeoXTrack	30	Dimension across track for footprint positions. Same as number of footprints per scanline. -- starting at the left and increasing towards the right as you look along the satellite's path
GeoTrack	# of scan lines in swath	Dimension along track for footprint positions. Same as number of scanlines in granule. Parallel to the satellite's path, increasing with time. (Nominally 45 for Level-2, AMSU-A, and AIRS/Vis low-rate engineering; 135 for AIRS/Vis and HSB high-rate quantities)
StdPressureLev	28	Number of standard pressure altitude levels (from bottom of the atmosphere up)
StdPressureLay	28	Number of standard pressure altitude layers (Always equal to StdPressureLev: last layer goes from level 1 to the top of the atmosphere)
AIRSXTrack	3	The number of AIRS cross-track spots per AMSU-A spot. Direction is the same as GeoXTrack -- starting at the left and increasing towards the right as you look along the satellite's path
AIRSTrack	3	The number of AIRS along-track spots per AMSU-A spot. Direction is the same as GeoTrack -- parallel to the satellite's path, increasing with time
Cloud	2	Cloud layer dimension in order of increasing pressure. Only first numCloud elements are valid
ChanAMSUA	15	Dimension of AMSU-A Channel array (Channel 1: 23.8 GHz; Ch 2: 31.4 GHz; Ch 3: 50.3 GHz; Ch 4: 52.8 GHz; Ch 5: 53.596 +/- 0.115 GHz; Ch 6: 54.4 GHz; Ch 7: 54.94 GHz; Ch 8: 55.5 GHz; Ch 9: f0; Ch 10: f0 +/- 0.217 GHz Ch 11: f0 +/- df +/- 48 MHz; Ch 12: f0 +/- df +/- 22 MHz; Ch 13: f0 +/- df +/- 10 MHz; Ch 14: f0 +/- df +/- 4.5 MHz; Ch 15: 89 GHz (f0 = 57290.344 MHz; df = 322.4 MHz))
ChanHSB	5	Dimension of HSB Channel array (Channel 1: Deleted 89.0 GHz channel: always invalid; Ch 2: 150.0 GHz; Ch 3: f0 +/- 1.0 GHz; Ch 4: f0 +/- 3.0 GHz; Ch 5: f0 +/- 7.0 GHz (f0 = 183.31 GHz))
MWHingeSurf	7	Number of standard frequency hinge points in Microwave surface emissivity and surface brightness. Frequencies are 23.8, 31.4, 50.3, 52.8, 89.0, 150.0, 183.3 GHz respectively.
HingeSurf	100	Maximum number of frequency hinge points in IR surface emissivity
Eta	9	Maximum number of cloud-clearing weights

### Geolocation Fields

These fields appear for every footprint (GeoTrack \* GeoXTrack times) and correspond to footprint center coordinates and "shutter" time.

Name	Explanation
Latitude	Footprint boresight geodetic Latitude in degrees North (-90.0 ... 90.0)
Longitude	Footprint boresight geodetic Longitude in degrees East (-180.0 ... 180.0)
Time	Footprint "shutter" TAI Time: floating-point elapsed seconds since Jan 1, 1993

Size: 32400 bytes (0.0 MB) per 45-scanset granule

### Attributes

These fields appear only once per granule

Name	Type	Extra Dimensions	Explanation
processing_level	string of 8-bit characters	None	Zero-terminated character string denoting processing level ("level2")
instrument	string of 8-bit	None	Zero-terminated character string denoting instrument ("AIRS")

	characters		
DayNightFlag	string of 8-bit characters	None	Zero-terminated character string denoting granule as day and/or night: (Always "Day", "Night", or "Both")
AutomaticQAFlag	string of 8-bit characters	None	Zero-terminated character string denoting granule data quality: (Always "Passed", "Failed", or "Suspect")
NumTotalData	32-bit integer	None	Total number of expected scene footprints
NumProcessData	32-bit integer	None	Number of scene footprints which are present and can be processed routinely (state = 0)
NumSpecialData	32-bit integer	None	Number of scene footprints which are present and can be processed only as a special test (state = 1)
NumBadData	32-bit integer	None	Number of scene footprints which are present but cannot be processed (state = 2)
NumMissingData	32-bit integer	None	Number of expected scene footprints which are not present (state = 3)
NumLandSurface	32-bit integer	None	Number of scene footprints for which the surface is more than 90% land
NumOceanSurface	32-bit integer	None	Number of scene footprints for which the surface is less than 10% land
node_type	string of 8-bit characters	None	Zero-terminated character string denoting whether granule is ascending, descending, or pole-crossing: ("Ascending" and "Descending" for entirely ascending or entirely descending granules, or "NorthPole" or "SouthPole" for pole-crossing granules)
start_year	32-bit integer	None	Year in which granule started, UTC (e.g. 1999)
start_month	32-bit integer	None	Month in which granule started, UTC (1 ... 12)
start_day	32-bit integer	None	Day of month in which granule started, UTC (1 ... 31)
start_hour	32-bit integer	None	Hour of day in which granule started, UTC (0 ... 23)
start_minute	32-bit integer	None	Minute of hour in which granule started, UTC (0 ... 59)
start_sec	32-bit floating-point	None	Second of minute in which granule started, UTC (0.0 ... 59.0)
start_orbit	32-bit integer	None	Orbit number of mission in which granule started
end_orbit	32-bit integer	None	Orbit number of mission in which granule ended
orbit_path	32-bit integer	None	Orbit path of start orbit (1 ... 233 as defined by EOS project)
start_orbit_row	32-bit integer	None	Orbit row at start of granule (1 ... 248 as defined by EOS project)
end_orbit_row	32-bit integer	None	Orbit row at end of granule (1 ... 248 as defined by EOS project)
granule_number	32-bit integer	None	Number of granule within day (1 ... 240)
num_scansets	32-bit integer	None	Number of scansets in granule (1 ... 45)
num_scanlines	32-bit integer	None	Number of scanlines in granule (1 * num_scansets)
start_Latitude	64-bit floating-point	None	Geodetic Latitude of spacecraft at start of granule in degrees North (-90.0 ... 90.0)
start_Longitude	64-bit floating-point	None	Geodetic Longitude of spacecraft at start of granule in degrees East (-180.0 ... 180.0)
start_Time	64-bit floating-point	None	TAI Time at start of granule (floating-point elapsed seconds since start of 1993)
end_Latitude	64-bit floating-point	None	Geodetic Latitude of spacecraft at end of granule in degrees North (-90.0 ... 90.0)
end_Longitude	64-bit floating-point	None	Geodetic Longitude of spacecraft at end of granule in degrees East (-180.0 ... 180.0)
end_Time	64-bit floating-point	None	TAI Time at end of granule (floating-point elapsed seconds since start of 1993)
eq_x_longitude	32-bit floating-point	None	Longitude of spacecraft at southward equator crossing nearest granule start in degrees East (-180.0 ... 180.0)
eq_x_tai	64-bit floating-point	None	Time of eq_x_longitude in TAI units (floating-point elapsed seconds since start of 1993)
orbitgeoqa	32-bit unsigned integer	None	Orbit Geolocation QA: bit 0 (LSB): bad input value (last scanline); bit 1: bad input value (first scanline); bit 2: PGS_EPH_GetEphMet() returned PGSEPH_E_NO_SC_EPHEM_FILE; bit 3: PGS_EPH_GetEphMet() returned PGSEPH_E_BAD_ARRAY_SIZE; bit 4: PGS_EPH_GetEphMet() returned PGSTD_E_TIME_FMT_ERROR; bit 5: PGS_EPH_GetEphMet() returned PGSTD_E_TIME_VALUE_ERROR; bit 6: PGS_EPH_GetEphMet() returned PGSTD_E_SC_TAG_UNKNOWN; bit 7: PGS_EPH_GetEphMet() returned PGS_E_TOOLKIT; bit 8: PGS_TD_UTCtoTAI() returned PGSTD_E_NO_LEAP_SECS; bit 9: PGS_TD_UTCtoTAI() returned PGSTD_E_TIME_FMT_ERROR; bit 10: PGS_TD_UTCtoTAI() returned PGSTD_E_TIME_VALUE_ERROR; bit 11: PGS_TD_UTCtoTAI() returned PGS_E_TOOLKIT; bit 12: PGS_CSC_DayNight() returned PGSTD_E_NO_LEAP_SECS; bit 13: PGS_CSC_DayNight() returned PGSCSC_E_INVALID_LIMITTAG; bit 14: PGS_CSC_DayNight() returned PGSCSC_E_BAD_ARRAY_SIZE; bit 15: PGS_CSC_DayNight() returned PGSCSC_W_ERROR_IN_DAYNIGHT; bit 16: PGS_CSC_DayNight() returned PGSCSC_W_BAD_TRANSFORM_VALUE; bit 17: PGS_CSC_DayNight() returned

			PGSCSC_W_BELOW_HORIZON; bit 18: PGS_CSC_DayNight() returned PGSCSC_W_PREDICTED_UT1; bit 19: PGS_CSC_DayNight() returned PGSTD_E_NO_UT1_VALUE; bit 20: PGS_CSC_DayNight() returned PGSTD_E_BAD_INITIAL_TIME; bit 21: PGS_CSC_DayNight() returned PGSCBP_E_TIME_OUT_OF_RANGE; bit 22: PGS_CSC_DayNight() returned PGSCBP_E_UNABLE_TO_OPEN_FILE; bit 22: PGS_CSC_DayNight() returned PGSMEM_E_NO_MEMORY; bit 24: PGS_CSC_DayNight() returned PGS_E_TOOLKIT; bit 25-31: not used
num_satgeoqa	16-bit integer	None	Number of scans with problems in satgeoqa
num_glntgeoqa	16-bit integer	None	Number of scans with problems in glntgeoqa
num_moongoqa	16-bit integer	None	Number of scans with problems in moongoqa
num_ftptgeoqa	16-bit integer	None	Number of footprints with problems in ftptgeoqa
num_zengeoqa	16-bit integer	None	Number of footprints with problems in zengeoqa
num_demgeoqa	16-bit integer	None	Number of footprints with problems in demgeoqa
num_fpe	16-bit integer	None	Number of floating point errors
LonGranuleCen	16-bit integer	None	Geodetic Longitude of the center of the granule in degrees East (-180 ... 180)
LatGranuleCen	16-bit integer	None	Geodetic Latitude of the center of the granule in degrees North (-90 ... 90)
LocTimeGranuleCen	16-bit integer	None	Local solar time at the center of the granule in minutes past midnight (0 ... 1439)
pressStd	32-bit floating-point	StdPressureLev (= 28)	Standard pressures in mb (bottom of the atmosphere first)
num_invalid	16-bit integer	None	# of footprints where invalid is True
num_clear_flag	16-bit integer	None	# of footprints 100% clear
num_MW_ret_used	16-bit integer	None	# of footprints where MW-only final retrieval used
num_retrieval_type	16-bit integer	None	# of footprints without full retrieval
granules_present	string of 8-bit characters	None	Zero-terminated character string denoting which adjacent granules were available for precipitation ("All" for both previous & next, "Prev" for previous but not next, "Next" for next but not previous, "None" for neither previous nor next)

Size: 294 bytes (0.0 MB) per granule

## Along-Track Data Fields

These fields appear once per scanline (GeoTrack times)

Name	Type	Extra Dimensions	Explanation
satheight	32-bit floating-point	None	Satellite altitude at nadirTAI in km above reference ellipsoid (e.g. 725.2)
satroll	32-bit floating-point	None	Satellite attitude roll angle at nadirTAI (-180.0 ... 180.0 angle about the +x (roll) ORB axis, +x axis is positively oriented in the direction of orbital flight completing an orthogonal triad with y and z.)
satpitch	32-bit floating-point	None	Satellite attitude pitch angle at nadirTAI (-180.0 ... 180.0 angle about +y (pitch) ORB axis, +y axis is oriented normal to the orbit plane with the positive sense opposite to that of the orbit's angular momentum vector H.)
satyaw	32-bit floating-point	None	Satellite attitude yaw angle at nadirTAI (-180.0 ... 180.0 angle about +z (yaw) axis, +z axis is positively oriented earthward parallel to the satellite radius vector R from the spacecraft center of mass to the center of the Earth.)
satgeoqa	32-bit unsigned integer	None	Satellite Geolocation QA flags: bit 0 (LSB): bad input value; bit 1: PGS_TD_TAItUTC() returned PGSTD_E_NO_LEAP_SECS; bit 2: PGS_TD_TAItUTC() returned PGS_E_TOOLKIT; bit 3: PGS_EPH_EphemAttit() returned PGSEPH_W_BAD_EPHEM_VALUE; bit 4: PGS_EPH_EphemAttit() returned PGSEPH_E_BAD_EPHEM_FILE_HDR; bit 5: PGS_EPH_EphemAttit() returned PGSEPH_E_NO_SC_EPHEM_FILE; bit 6: PGS_EPH_EphemAttit() returned PGSEPH_E_NO_DATA_REQUESTED; bit 7: PGS_EPH_EphemAttit() returned PGSTD_E_SC_TAG_UNKNOWN; bit 8: PGS_EPH_EphemAttit() returned PGSEPH_E_BAD_ARRAY_SIZE; bit 9: PGS_EPH_EphemAttit() returned PGSTD_E_TIME_FMT_ERROR; bit 10: PGS_EPH_EphemAttit() returned PGSTD_E_TIME_VALUE_ERROR; bit 11: PGS_EPH_EphemAttit() returned PGSTD_E_NO_LEAP_SECS; bit 12: PGS_EPH_EphemAttit() returned PGS_E_TOOLKIT; bit 13: PGS_CSC_ECItECR() returned PGSCSC_W_BAD_TRANSFORM_VALUE; bit 14: PGS_CSC_ECItECR() returned PGSCSC_E_BAD_ARRAY_SIZE; bit 15: PGS_CSC_ECItECR() returned PGSTD_E_NO_LEAP_SECS; bit 16: PGS_CSC_ECItECR() returned PGSTD_E_TIME_FMT_ERROR; bit 17: PGS_CSC_ECItECR() returned PGSTD_E_TIME_VALUE_ERROR; bit 18: unused (set to zero); bit 19: PGS_CSC_ECItECR() returned PGSTD_E_NO_UT1_VALUE; bit 20: PGS_CSC_ECItECR() returned PGS_E_TOOLKIT; bit 21: PGS_CSC_ECRtoGEO() returned PGSCSC_W_TOO_MANY_ITERS; bit 22: PGS_CSC_ECRtoGEO() returned PGSCSC_W_INVALID_ALTITUDE; bit 23: PGS_CSC_ECRtoGEO() returned PGSCSC_W_SPHERE_BODY; bit 24: PGS_CSC_ECRtoGEO() returned PGSCSC_W_LARGE_FLATTENING; bit 25: PGS_CSC_ECRtoGEO() returned PGSCSC_W_DEFAULT_EARTH_MODEL; bit 26: PGS_CSC_ECRtoGEO() returned PGSCSC_E_BAD_EARTH_MODEL; bit 27: PGS_CSC_ECRtoGEO() returned PGS_E_TOOLKIT; bit 28-31: not used

glintgeoqa	16-bit unsigned integer	None	Glint Geolocation QA flags: bit 0 (LSB): bad input value; bit 1: glint location in Earth's shadow; bit 2: glint calculation not converging; bit 3: glint location sun vs. satellite zenith mismatch; bit 4: glint location sun vs. satellite azimuth mismatch; bit 5: bad glint location; bit 6: PGS_CSC_ZenithAzimuth() returned any 'W' class return code; bit 7: PGS_CSC_ZenithAzimuth() returned any 'E' class return code; bit 8: PGS_CBP_Earth_CB_Vector() returned returned any 'W' class return code; bit 9: PGS_CBP_Earth_CB_Vector() returned returned any 'E' class return code; bit 10: PGS_CSC_ECIttoECR() returned any 'W' class return code except PGSCSC_W_PREDICTED_UT1 (for Glint); bit 11: PGS_CSC_ECIttoECR() returned any 'E' class return code (for Glint); bit 12: PGS_CSC_ECRtoGEO() returned any 'W' class return code (for Glint); bit 13: PGS_CSC_ECRtoGEO() returned any 'E' class return code (for Glint); bit 14: PGS_CSC_ECIttoECR() returned any 'W' class return code except PGSCSC_W_PREDICTED_UT1; bit 15: PGS_CSC_ECIttoECR() returned any 'E' class return code
moongeoa	16-bit unsigned integer	None	Moon Geolocation QA flags: bit 0 (LSB): bad input value; bit 1: PGS_TD_TAIttoUTC() returned PGSTD_E_NO_LEAP_SECS; bit 2: PGS_TD_TAIttoUTC() returned PGS_E_TOOLKIT; bit 3: PGS_CBP_Sat_CB_Vector() returned PGSCSC_W_BELOW_SURFACE; bit 4: PGS_CBP_Sat_CB_Vector() returned PGSCBP_W_BAD_CB_VECTOR; bit 5: PGS_CBP_Sat_CB_Vector() returned PGSCBP_E_BAD_ARRAY_SIZE; bit 6: PGS_CBP_Sat_CB_Vector() returned PGSCBP_E_INVALID_CB_ID; bit 7: PGS_CBP_Sat_CB_Vector() returned PGSMEM_E_NO_MEMORY; bit 8: PGS_CBP_Sat_CB_Vector() returned PGSCBP_E_UNABLE_TO_OPEN_FILE; bit 9: PGS_CBP_Sat_CB_Vector() returned PGSTD_E_BAD_INITIAL_TIME; bit 10: PGS_CBP_Sat_CB_Vector() returned PGSCBP_E_TIME_OUT_OF_RANGE; bit 11: PGS_CBP_Sat_CB_Vector() returned PGSTD_E_SC_TAG_UNKNOWN; bit 12: PGS_CBP_Sat_CB_Vector() returned PGSEPH_E_BAD_EPHEM_FILE_HDR; bit 13: PGS_CBP_Sat_CB_Vector() returned PGSEPH_E_NO_SC_EPHEM_FILE; bit 14: PGS_CBP_Sat_CB_Vector() returned PGS_E_TOOLKIT; bit 15: not used
nadirTAI	64-bit floating-point	None	TAI time at which instrument is nominally looking directly down. (between footprints 15 & 16 for AMSU or between footprints 45 & 46 for AIRS/Vis & HSB) (floating-point elapsed seconds since start of 1993)
sat_lat	64-bit floating-point	None	Satellite geodetic latitude in degrees North (-90.0 ... 90.0)
sat_lon	64-bit floating-point	None	Satellite geodetic longitude in degrees East (-180.0 ... 180.0)
scan_node_type	8-bit integer	None	'A' for ascending, 'D' for descending, 'N' for North-Polar, 'S' for South-Polar
glintlat	32-bit floating-point	None	Solar glint geodetic latitude in degrees North at nadirTAI (-90.0 ... 90.0)
glintlon	32-bit floating-point	None	Solar glint geodetic longitude in degrees East at nadirTAI (-180.0 ... 180.0)

Size: 2565 bytes (0.0 MB) per 45-scanset granule

## Full Swath Data Fields

These fields appear for every footprint of every scanline in the granule (GeoTrack \* GeoXTrack times)

Name	Type	Extra Dimensions	Explanation
RetQAFlag	16-bit unsigned integer	None	Retrieval QA flags: users are advised not to use unless all bits are zero. bits 10-15: spare, set to zero.; bit 9 (value 512): retrieved ocean SST disagrees with NCEP forecast by at least 3 K; bit 8 (value 256): This record type not yet validated; bits 5-7: spare, set to zero; bit 4 (value 16): Final retrieval rejected or not attempted; bit 3 (value 8): Final Cloud Clearing rejected or not attempted; bit 2 (value 4): Regression First Guess rejected or not attempted; bit 1 (value 2): Initial Cloud Clearing rejected or not attempted; bit 0 (LSB, value 1): MW retrieval rejected or not attempted
ftptgeoqa	32-bit unsigned integer	None	Footprint Geolocation QA flags: bit 0 (LSB): bad input value; bit 1: PGS_TD_TAIttoUTC() returned PGSTD_E_NO_LEAP_SECS; bit 2: PGS_TD_TAIttoUTC() returned PGS_E_TOOLKIT; bit 3: PGS_CSC_GetFOV_Pixel() returned PGSCSC_W_MISS_EARTH; bit 4: PGS_CSC_GetFOV_Pixel() returned PGSTD_E_SC_TAG_UNKNOWN; bit 5: PGS_CSC_GetFOV_Pixel() returned PGSCSC_W_ZERO_PIXEL_VECTOR; bit 6: PGS_CSC_GetFOV_Pixel() returned PGSCSC_W_BAD_EPHEM_FOR_PIXEL; bit 7: PGS_CSC_GetFOV_Pixel() returned PGSCSC_W_INSTRUMENT_OFF_BOARD; bit 8: PGS_CSC_GetFOV_Pixel() returned PGSCSC_W_BAD_ACCURACY_FLAG; bit 9: PGS_CSC_GetFOV_Pixel() returned PGSCSC_E_BAD_ARRAY_SIZE; bit 10: PGS_CSC_GetFOV_Pixel() returned PGSCSC_W_DEFAULT_EARTH_MODEL; bit 11: PGS_CSC_GetFOV_Pixel() returned PGSCSC_W_DATA_FILE_MISSING; bit 12: PGS_CSC_GetFOV_Pixel() returned PGSCSC_E_NEG_OR_ZERO_RAD; bit 13: PGS_CSC_GetFOV_Pixel() returned PGSMEM_E_NO_MEMORY; bit 14: PGS_CSC_GetFOV_Pixel() returned PGSTD_E_NO_LEAP_SECS; bit 15: PGS_CSC_GetFOV_Pixel() returned PGSTD_E_TIME_FMT_ERROR; bit 16: PGS_CSC_GetFOV_Pixel() returned PGSTD_E_TIME_VALUE_ERROR; bit 17: PGS_CSC_GetFOV_Pixel() returned PGSCSC_W_PREDICTED_UT1; bit 18: PGS_CSC_GetFOV_Pixel() returned PGSTD_E_NO_UT1_VALUE; bit 19: PGS_CSC_GetFOV_Pixel() returned PGS_E_TOOLKIT; bit 20: PGS_CSC_GetFOV_Pixel() returned PGSEPH_E_BAD_EPHEM_FILE_HDR; bit 21: PGS_CSC_GetFOV_Pixel() returned PGSEPH_E_NO_SC_EPHEM_FILE; bit 22-31: not used
zengeoqa	16-bit unsigned integer	None	Satellite zenith Geolocation QA flags: bit 0 (LSB): (Spacecraft) bad input value; bit 1: PGS_CSC_ZenithAzimuth(S/C) returned PGSCSC_W_BELOW_HORIZON; bit 2: PGS_CSC_ZenithAzimuth(S/C) returned PGSCSC_W_UNDEFINED_AZIMUTH; bit 3: PGS_CSC_ZenithAzimuth(S/C) returned PGSCSC_W_NO_REFRACTION; bit 4: PGS_CSC_ZenithAzimuth(S/C) returned PGSCSC_E_INVALID_VECTAG; bit 5: PGS_CSC_ZenithAzimuth(S/C) returned PGSCSC_F_LOOK_PT_AITIT_RANGE; bit

			6: PGS_CSC_ZenithAzimuth(S/C) returned PGSCSC_E_ZERO_INPUT_VECTOR; bit 7: PGS_CSC_ZenithAzimuth(S/C) returned PGS_E_TOOLKIT; bit 8: (Sun) bad input value; bit 9: (suppressed) PGS_CSC_ZenithAzimuth(Sun) returned PGSCSC_W_BELOW_HORIZON (This is not an error condition - the sun is below the horizon at night); bit 10: PGS_CSC_ZenithAzimuth(Sun) returned PGSCSC_W_UNDEFINED_AZIMUTH; bit 11: PGS_CSC_ZenithAzimuth(Sun) returned PGSCSC_W_NO_REFRACTION; bit 12: PGS_CSC_ZenithAzimuth(Sun) returned PGSCSC_E_INVALID_VECTAG; bit 13: PGS_CSC_ZenithAzimuth(Sun) returned PGSCSC_E_LOOK_PT_ALTIT_RANGE; bit 14: PGS_CSC_ZenithAzimuth(Sun) returned PGSCSC_E_ZERO_INPUT_VECTOR; bit 15: PGS_CSC_ZenithAzimuth(Sun) returned PGS_E_TOOLKIT
demgeoqa	16-bit unsigned integer	None	Digital Elevation Model (DEM) Geolocation QA flags: bit 0 (LSB): bad input value; bit 1: Could not allocate memory; bit 2: Too close to North or South pole. Excluded; bit 3: Layer resolution incompatibility. Excluded; bit 4: Any DEM Routine (elev) returned PGSDM_E_IMPROPER_TAG; bit 5: Any DEM Routine (elev) returned PGSDM_E_CANNOT_ACCESS_DATA; bit 6: Any DEM Routine (land/water) returned PGSDM_E_IMPROPER_TAG; bit 7: Any DEM Routine (land/water) returned PGSDM_E_CANNOT_ACCESS_DATA; bit 8: Reserved for future layers; bit 9: Reserved for future layers; bit 10: PGS_DEM_GetRegion(elev) returned PGSDM_M_FILLVALUE_INCLUDED; bit 11: PGS_DEM_GetRegion(land/water) returned PGSDM_M_FILLVALUE_INCLUDED; bit 12: Reserved for future layers; bit 13: PGS_DEM_GetRegion(all) returned PGSDM_M_MULTIPLE_RESOLUTIONS; bit 14: PGS_CSC_GetFOV_Pixel() returned any 'W' class return code except PGSCSC_W_PREDICTED_UT1; bit 15: PGS_CSC_GetFOV_Pixel() returned any 'E' class return code
satzen	32-bit floating-point	None	Spacecraft zenith angle (0.0 ... 180.0) degrees from zenith (measured relative to the geodetic vertical on the reference (WGS84) spheroid and including corrections outlined in EOS SDP toolkit for normal accuracy.)
satazi	32-bit floating-point	None	Spacecraft azimuth angle (-180.0 ... 180.0) degrees E of N GEO
solzen	32-bit floating-point	None	Solar zenith angle (0.0 ... 180.0) degrees from zenith (measured relative to the geodetic vertical on the reference (WGS84) spheroid and including corrections outlined in EOS SDP toolkit for normal accuracy.)
solazi	32-bit floating-point	None	Solar azimuth angle (-180.0 ... 180.0) degrees E of N GEO
sun_glint_distance	16-bit integer	None	Distance (km) from footprint center to location of the sun glint (-9999 for unknown, 30000 for no glint visible because spacecraft is in Earth's shadow)
topog	32-bit floating-point	None	Mean topography in meters above reference ellipsoid
topog_err	32-bit floating-point	None	Error estimate for topog
landFrac	32-bit floating-point	None	Fraction of spot that is land (0.0 ... 1.0)
landFrac_err	32-bit floating-point	None	Error estimate for landFrac
latAIRS	32-bit floating-point	AIRSTrack (= 3) * AIRSXTrack (= 3)	Geodetic center latitude of AIRS spots in degrees North (-90.0 ... 90.0)
lonAIRS	32-bit floating-point	AIRSTrack (= 3) * AIRSXTrack (= 3)	Geodetic center longitude of AIRS spots in degrees East (-180.0 ... 180.0)
numHingeSurf	16-bit integer	None	Number of IR hinge points for surface emissivity and reflectivity
numCloud	32-bit integer	None	Number of cloud layers
freqEmis	32-bit floating-point	HingeSurf (= 100)	Frequencies for surface emissivity and reflectivity in cm-1 (in order of increasing frequency. Only first numHingeSurf elements are valid)
PSurfStd	32-bit floating-point	None	Surface pressure first guess in mb, interpolated from forecast
nSurfStd	32-bit integer	None	Index in pressStd array of first pressure level above mean surface (25 ... 30)
TSurfStd	32-bit floating-point	None	Surface skin temperature in Kelvins
TSurfAir	32-bit floating-point	None	Surface air temperature in Kelvins
TAirStd	32-bit floating-point	StdPressureLev (= 28)	Atmospheric Temperature at StdPressLev in Kelvins
H2OMMRStd	32-bit floating-point	StdPressureLev (= 28)	Water Vapor Mass Mixing Ratio (gm / kg dry air)
H2OMMRSat	32-bit floating-point	StdPressureLev (= 28)	Water vapor saturation mass mixing ratio (gm / kg dry air)
totH2OStd	32-bit floating-point	None	Total precipitable water vapor (kg / m**2)
O3VMRStd	32-bit floating-point	StdPressureLev (= 28)	Ozone Volume Mixing Ratio (vmr)

totO3Std	32-bit floating-point	None	Total ozone burden (Dobson units)
emisIRStd	32-bit floating-point	HingeSurf (= 100)	Spectral IR Surface Emissivities (in order of increasing frequency. Only first numHingeSurf elements are valid)
rhoIRStd	32-bit floating-point	HingeSurf (= 100)	Spectral IR Bidirectional Surface Reflectivities (in order of increasing frequency. Only first numHingeSurf elements are valid)
sfcTbMWStd	32-bit floating-point	MWHingeSurf (= 7)	Microwave surface brightness (Kelvins) (Emitted radiance only; reflected radiance not included)
EmisMWStd	32-bit floating-point	MWHingeSurf (= 7)	Spectral emissivity at the 7 MW frequencies listed for dimension MWHingeSurf (sfcTbMWStd / TSurfStd, or Undefined if IR fails)
totCldH2OStd	32-bit floating-point	None	Total cloud liquid water in kg/m**2
TCldTopStd	32-bit floating-point	Cloud (= 2)	Cloud top temperature in Kelvins (in order of increasing pressure. Only first numCloud elements are valid)
PCldTopStd	32-bit floating-point	Cloud (= 2)	Cloud top pressure in mb
CldFrcStd	32-bit floating-point	AIRSTrack (= 3) * AIRSXTrack (= 3) * Cloud (= 2)	Cloud fraction (0.0 ... 1.0) assuming the cloud emissivity at 930 cm-1 is unity (in order of increasing pressure. Only first numCloud elements are valid)
CldClearParamStd	32-bit floating-point	Eta (= 9)	Cloud clearing parameter Eta
PSurfStdErr	32-bit floating-point	None	Error estimate for PSurfStd
TSurfStdErr	32-bit floating-point	None	Error estimate for TSurfStd
TAirStdErr	32-bit floating-point	StdPressureLev (= 28)	Error estimate for TAirStd
H2OMMRStdErr	32-bit floating-point	StdPressureLev (= 28)	Error estimate for H2OMMRStd
totH2OStdErr	32-bit floating-point	None	Error estimate for totH2OStd
O3VMRStdErr	32-bit floating-point	StdPressureLev (= 28)	Error estimate for O3VMRStd
totO3StdErr	32-bit floating-point	None	Error estimate for totO3Std
emisIRStdErr	32-bit floating-point	HingeSurf (= 100)	Error estimate for emisIRStd
rhoIRStdErr	32-bit floating-point	HingeSurf (= 100)	Error estimate for rhoIRStd
EmisMWStdErr	32-bit floating-point	MWHingeSurf (= 7)	Error estimate for EmisMWStd
totCldH2OStdErr	32-bit floating-point	None	Error estimate for totCldH2OStd
TCldTopStdErr	32-bit floating-point	Cloud (= 2)	Error estimate for TCldTopStd
PCldTopStdErr	32-bit floating-point	Cloud (= 2)	Error estimate for PCldTopStd
CldFrcStdErr	32-bit floating-point	AIRSTrack (= 3) * AIRSXTrack (= 3) * Cloud (= 2)	Error estimate for CldFrcStd
CldClearParamStdErr	32-bit floating-point	Eta (= 9)	Error estimate for CldClearParamStd
GP_Height	32-bit floating-point	StdPressureLev (= 28)	Geopotential Heights at StdPressureLev (m above mean sea level)
GP_Surface	32-bit floating-point	None	Geopotential Height of surface (m above mean sea level)
clear_flag_4um	8-bit integer	AIRSTrack (= 3) * AIRSXTrack (= 3)	Clear flag based on level of agreement of predicted SST using AIRS 4 microns (2616 & 2707 cm^-1) observations with SST from a forecast model combined with a spatial homogeneity test of the brightness temperature at 2616 cm^-1 over 3X3 AIRS footprints. 1: believed clear; 0: clear test failed or inconclusive; -1/255: clear test not attempted.
clear_flag_11um	8-bit integer	AIRSTrack (= 3) * AIRSXTrack (= 3)	Clear flag based on level of agreement of predicted SST using AIRS 11 microns split window observations with SST from a forecast model combined with a spatial homogeneity test of the SST agreement described above over 3X3 AIRS footprints. 1: believed clear; 0: clear test failed or inconclusive; -1/255: clear test not attempted.
invalid	8-bit integer	None	No valid output (1: True, 0: False, 255/-1: Unknown)



clear_flag	8-bit integer	None	1 for 100% clear, 0 for
MW_ret_used	8-bit integer	None	MW-only final retrieval used (1: True, 0: False, 255/-1: Unknown)
retrieval_type	8-bit integer	None	Deprecated -- use RetQAFlag. Retrieval type: 0 for full retrieval; 10 for MW + final succeeded, initial retrieval failed; 20 for MW + initial succeeded, final failed; 30 for only MW stage succeeded, initial + final retrieval failed; 40 for MW + initial succeeded, final cloud-clearing failed; 50 for only MW stage succeeded, initial + final cloud-clearing failed; 100 for no retrieval;

Size: 4622400 bytes (4.6 MB) per 45-scanset granule

**Total File Size (plus storage for dimensions and other HDF-EOS overhead):  
4657659 bytes (4.7 MB) per 45-scanset granule = 1117.8 MB per day**

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## A-8. L2 Standard Cloud-Cleared Radiance Product Interface Specification

Interface Specification Version 3.0.4.0  
2003-05-19

ESDT ShortName = "AIRI2CCF"

Swath Name = "L2\_Standard\_cloud-cleared\_radiance\_product"

Level = "level2"

# Footprints = 30

# scanlines per scanset = 1

### Dimensions

These fields define all dimensions that can be used for HDF-EOS swath fields.

The names "GeoTrack" and "GeoXTrack" have a special meaning for this document: "Cross-Track" data fields have a hidden dimension of "GeoXTrack"; "Along-Track" data fields have a hidden dimension of "GeoTrack"; "Full Swath Data Fields have hidden dimensions of both "GeoTrack" and "GeoXTrack".

Name	Value	Explanation
GeoXTrack	30	Dimension across track for footprint positions. Same as number of footprints per scanline. -- starting at the left and increasing towards the right as you look along the satellite's path
GeoTrack	# of scan lines in swath	Dimension along track for footprint positions. Same as number of scanlines in granule. Parallel to the satellite's path, increasing with time. (Nominally 45 for Level-2, AMSU-A, and AIRS/Vis low-rate engineering; 135 for AIRS/Vis and HSB high-rate quantities)
Channel	2378	Dimension of channel array (Channels are generally in order of increasing wavenumber, but because frequencies can vary and because all detectors from a physical array of detector elements (a "module") are always grouped together there are sometimes small reversals in frequency order where modules overlap.)

### Geolocation Fields

These fields appear for every footprint (GeoTrack \* GeoXTrack times) and correspond to footprint center coordinates and "shutter" time.

Name	Explanation
Latitude	Footprint boresight geodetic Latitude in degrees North (-90.0 ... 90.0)
Longitude	Footprint boresight geodetic Longitude in degrees East (-180.0 ... 180.0)
Time	Footprint "shutter" TAI Time: floating-point elapsed seconds since Jan 1, 1993

Size: 32400 bytes (0.0 MB) per 45-scanset granule

### Attributes

These fields appear only once per granule

Name	Type	Extra Dimensions	Explanation
freq	32-bit floating-point	Channel (= 2378)	Frequencies associated with each channel (in cm**1)
processing_level	string of 8-bit characters	None	Zero-terminated character string denoting processing level ("level2")
instrument	string of 8-bit characters	None	Zero-terminated character string denoting instrument ("AIRS")
DayNightFlag	string of 8-bit characters	None	Zero-terminated character string denoting granule as day and/or night: (Always "Day", "Night", or "Both")
AutomaticQAFlag	string of 8-bit characters	None	Zero-terminated character string denoting granule data quality: (Always "Passed", "Failed", or "Suspect")
NumTotalData	32-bit integer	None	Total number of expected scene footprints
NumProcessData	32-bit integer	None	Number of scene footprints which are present and can be processed routinely (state = 0)
NumSpecialData	32-bit integer	None	Number of scene footprints which are present and can be processed only as a special test (state = 1)
NumBadData	32-bit integer	None	Number of scene footprints which are present but cannot be processed (state = 2)
NumMissingData	32-bit integer	None	Number of expected scene footprints which are not present (state = 3)
NumLandSurface	32-bit integer	None	Number of scene footprints for which the surface is more than 90% land

NumOceanSurface	32-bit integer	None	Number of scene footprints for which the surface is less than 10% land
node_type	string of 8-bit characters	None	Zero-terminated character string denoting whether granule is ascending, descending, or pole-crossing: ("Ascending" and "Descending" for entirely ascending or entirely descending granules, or "NorthPole" or "SouthPole" for pole-crossing granules)
start_year	32-bit integer	None	Year in which granule started, UTC (e.g. 1999)
start_month	32-bit integer	None	Month in which granule started, UTC (1 ... 12)
start_day	32-bit integer	None	Day of month in which granule started, UTC (1 ... 31)
start_hour	32-bit integer	None	Hour of day in which granule started, UTC (0 ... 23)
start_minute	32-bit integer	None	Minute of hour in which granule started, UTC (0 ... 59)
start_sec	32-bit floating-point	None	Second of minute in which granule started, UTC (0.0 ... 59.0)
start_orbit	32-bit integer	None	Orbit number of mission in which granule started
end_orbit	32-bit integer	None	Orbit number of mission in which granule ended
orbit_path	32-bit integer	None	Orbit path of start orbit (1 ... 233 as defined by EOS project)
start_orbit_row	32-bit integer	None	Orbit row at start of granule (1 ... 248 as defined by EOS project)
end_orbit_row	32-bit integer	None	Orbit row at end of granule (1 ... 248 as defined by EOS project)
granule_number	32-bit integer	None	Number of granule within day (1 ... 240)
num_scansets	32-bit integer	None	Number of scansets in granule (1 ... 45)
num_scanlines	32-bit integer	None	Number of scanlines in granule (3 * num_scansets)
start_Latitude	64-bit floating-point	None	Geodetic Latitude of spacecraft at start of granule in degrees North (-90.0 ... 90.0)
start_Longitude	64-bit floating-point	None	Geodetic Longitude of spacecraft at start of granule in degrees East (-180.0 ... 180.0)
start_Time	64-bit floating-point	None	TAI Time at start of granule (floating-point elapsed seconds since start of 1993)
end_Latitude	64-bit floating-point	None	Geodetic Latitude of spacecraft at end of granule in degrees North (-90.0 ... 90.0)
end_Longitude	64-bit floating-point	None	Geodetic Longitude of spacecraft at end of granule in degrees East (-180.0 ... 180.0)
end_Time	64-bit floating-point	None	TAI Time at end of granule (floating-point elapsed seconds since start of 1993)
eq_x_longitude	32-bit floating-point	None	Longitude of spacecraft at southward equator crossing nearest granule start in degrees East (-180.0 ... 180.0)
eq_x_tai	64-bit floating-point	None	Time of eq_x_longitude in TAI units (floating-point elapsed seconds since start of 1993)
orbitgeoqa	32-bit unsigned integer	None	Orbit Geolocation QA: bit 0 (LSB): bad input value (last scanline); bit 1: bad input value (first scanline); bit 2: PGS_EPH_GetEphMet() returned PGSEPH_E_NO_SC_EPHEM_FILE; bit 3: PGS_EPH_GetEphMet() returned PGSEPH_E_BAD_ARRAY_SIZE; bit 4: PGS_EPH_GetEphMet() returned PGSTD_E_TIME_FMT_ERROR; bit 5: PGS_EPH_GetEphMet() returned PGSTD_E_TIME_VALUE_ERROR; bit 6: PGS_EPH_GetEphMet() returned PGSTD_E_SC_TAG_UNKNOWN; bit 7: PGS_EPH_GetEphMet() returned PGS_E_TOOLKIT; bit 8: PGS_TD_UTCtoTAI() returned PGSTD_E_NO_LEAP_SECS; bit 9: PGS_TD_UTCtoTAI() returned PGSTD_E_TIME_FMT_ERROR; bit 10: PGS_TD_UTCtoTAI() returned PGSTD_E_TIME_VALUE_ERROR; bit 11: PGS_TD_UTCtoTAI() returned PGS_E_TOOLKIT; bit 12: PGS_CSC_DayNight() returned PGSTD_E_NO_LEAP_SECS; bit 13: PGS_CSC_DayNight() returned PGSCSC_E_INVALID_LIMITTAG; bit 14: PGS_CSC_DayNight() returned PGSCSC_E_BAD_ARRAY_SIZE; bit 15: PGS_CSC_DayNight() returned PGSCSC_W_ERROR_IN_DAYNIGHT; bit 16: PGS_CSC_DayNight() returned PGSCSC_W_BAD_TRANSFORM_VALUE; bit 17: PGS_CSC_DayNight() returned PGSCSC_W_BELOW_HORIZON; bit 18: PGS_CSC_DayNight() returned PGSCSC_W_PREDICTED_UT1; bit 19: PGS_CSC_DayNight() returned PGSTD_E_NO_UT1_VALUE; bit 20: PGS_CSC_DayNight() returned PGSTD_E_BAD_INITIAL_TIME; bit 21: PGS_CSC_DayNight() returned PGSCBP_E_TIME_OUT_OF_RANGE; bit 22: PGS_CSC_DayNight() returned PGSCBP_E_UNABLE_TO_OPEN_FILE; bit 23: PGS_CSC_DayNight() returned PGSMEM_E_NO_MEMORY; bit 24: PGS_CSC_DayNight() returned PGS_E_TOOLKIT; bit 25-31: not used
num_satgeoqa	16-bit integer	None	Number of scans with problems in satgeoqa
num_glintgeoqa	16-bit integer	None	Number of scans with problems in glintgeoqa
num_moongoqa	16-bit integer	None	Number of scans with problems in moongoqa
num_ftptgeoqa	16-bit integer	None	Number of footprints with problems in ftptgeoqa
num_zengeoqa	16-bit integer	None	Number of footprints with problems in zengeoqa
num_demgeoqa	16-bit integer	None	Number of footprints with problems in demgeoqa

num_fpe	16-bit integer	None	Number of floating point errors
LonGranuleCen	16-bit integer	None	Geodetic Longitude of the center of the granule in degrees East (-180 ... 180)
LatGranuleCen	16-bit integer	None	Geodetic Latitude of the center of the granule in degrees North (-90 ... 90)
LocTimeGranuleCen	16-bit integer	None	Local solar time at the center of the granule in minutes past midnight (0 ... 1439)
num_invalid	16-bit integer	None	# of footprints where invalid is True
num_clear_flag	16-bit integer	None	# of footprints 100% clear
num_MW_ret_used	16-bit integer	None	# of footprints where MW-only final retrieval used
num_retrieval_type	16-bit integer	None	# of footprints without full retrieval

Size: 9693 bytes (0.0 MB) per granule

## Along-Track Data Fields

These fields appear once per scanline (GeoTrack times)

Name	Type	Extra Dimensions	Explanation
satheight	32-bit floating-point	None	Satellite altitude at nadirTAI in km above reference ellipsoid (e.g. 725.2)
satroll	32-bit floating-point	None	Satellite attitude roll angle at nadirTAI (-180.0 ... 180.0 angle about the +x (roll) ORB axis. +x axis is positively oriented in the direction of orbital flight completing an orthogonal triad with y and z.)
satpitch	32-bit floating-point	None	Satellite attitude pitch angle at nadirTAI (-180.0 ... 180.0 angle about +y (pitch) ORB axis. +y axis is oriented normal to the orbit plane with the positive sense opposite to that of the orbit's angular momentum vector H.)
satyaw	32-bit floating-point	None	Satellite attitude yaw angle at nadirTAI (-180.0 ... 180.0 angle about +z (yaw) axis. +z axis is positively oriented earthward parallel to the satellite radius vector R from the spacecraft center of mass to the center of the Earth.)
satgeoqa	32-bit unsigned integer	None	Satellite Geolocation QA flags: bit 0 (LSB): bad input value; bit 1: PGS_TD_TAItUTC() returned PGSTD_E_NO_LEAP_SECS; bit 2: PGS_TD_TAItUTC() returned PGS_E_TOOLKIT; bit 3: PGS_EPH_EphemAttit() returned PGSEPH_W_BAD_EPHEM_VALUE; bit 4: PGS_EPH_EphemAttit() returned PGSEPH_E_BAD_EPHEM_FILE_HDR; bit 5: PGS_EPH_EphemAttit() returned PGSEPH_E_NO_SC_EPHEM_FILE; bit 6: PGS_EPH_EphemAttit() returned PGSEPH_E_NO_DATA_REQUESTED; bit 7: PGS_EPH_EphemAttit() returned PGSTD_E_SC_TAG_UNKNOWN; bit 8: PGS_EPH_EphemAttit() returned PGSEPH_E_BAD_ARRAY_SIZE; bit 9: PGS_EPH_EphemAttit() returned PGSTD_E_TIME_FMT_ERROR; bit 10: PGS_EPH_EphemAttit() returned PGSTD_E_TIME_VALUE_ERROR; bit 11: PGS_EPH_EphemAttit() returned PGSTD_E_NO_LEAP_SECS; bit 12: PGS_EPH_EphemAttit() returned PGS_E_TOOLKIT; bit 13: PGS_CSC_ECIttoECR() returned PGSCSC_W_BAD_TRANSFORM_VALUE; bit 14: PGS_CSC_ECIttoECR() returned PGSCSC_E_BAD_ARRAY_SIZE; bit 15: PGS_CSC_ECIttoECR() returned PGSTD_E_NO_LEAP_SECS; bit 16: PGS_CSC_ECIttoECR() returned PGSTD_E_TIME_FMT_ERROR; bit 17: PGS_CSC_ECIttoECR() returned PGSTD_E_TIME_VALUE_ERROR; bit 18: unused (set to zero); bit 19: PGS_CSC_ECIttoECR() returned PGSTD_E_NO_UT1_VALUE; bit 20: PGS_CSC_ECIttoECR() returned PGS_E_TOOLKIT; bit 21: PGS_CSC_ECRtoGEO() returned PGSCSC_W_TOO_MANY_ITERS; bit 22: PGS_CSC_ECRtoGEO() returned PGSCSC_W_INVALID_ALTITUDE; bit 23: PGS_CSC_ECRtoGEO() returned PGSCSC_W_SPHERE_BODY; bit 24: PGS_CSC_ECRtoGEO() returned PGSCSC_W_LARGE_FLATTENING; bit 25: PGS_CSC_ECRtoGEO() returned PGSCSC_W_DEFAULT_EARTH_MODEL; bit 26: PGS_CSC_ECRtoGEO() returned PGSCSC_E_BAD_EARTH_MODEL; bit 27: PGS_CSC_ECRtoGEO() returned PGS_E_TOOLKIT; bit 28-31: not used
glintgeoqa	16-bit unsigned integer	None	Glint Geolocation QA flags: bit 0 (LSB): bad input value; bit 1: glint location in Earth's shadow; bit 2: glint calculation not converging; bit 3: glint location sun vs. satellite zenith mismatch; bit 4: glint location sun vs. satellite azimuth mismatch; bit 5: bad glint location; bit 6: PGS_CSC_ZenithAzimuth() returned any 'W' class return code; bit 7: PGS_CSC_ZenithAzimuth() returned any 'E' class return code; bit 8: PGS_CBP_Earth_CB_Vector() returned returned any 'W' class return code; bit 9: PGS_CBP_Earth_CB_Vector() returned returned any 'E' class return code; bit 10: PGS_CSC_ECIttoECR() returned any 'W' class return code except PGSCSC_W_PREDICTED_UT1 (for Glint); bit 11: PGS_CSC_ECIttoECR() returned any 'E' class return code (for Glint); bit 12: PGS_CSC_ECRtoGEO() returned any 'W' class return code (for Glint); bit 13: PGS_CSC_ECRtoGEO() returned any 'E' class return code (for Glint); bit 14: PGS_CSC_ECIttoECR() returned any 'W' class return code except PGSCSC_W_PREDICTED_UT1; bit 15: PGS_CSC_ECIttoECR() returned any 'E' class return code
moongeoqa	16-bit unsigned integer	None	Moon Geolocation QA flags: bit 0 (LSB): bad input value; bit 1: PGS_TD_TAItUTC() returned PGSTD_E_NO_LEAP_SECS; bit 2: PGS_TD_TAItUTC() returned PGS_E_TOOLKIT; bit 3: PGS_CBP_Sat_CB_Vector() returned PGSCSC_W_BELOW_SURFACE; bit 4: PGS_CBP_Sat_CB_Vector() returned PGSCBP_W_BAD_CB_VECTOR; bit 5: PGS_CBP_Sat_CB_Vector() returned PGSCBP_E_BAD_ARRAY_SIZE; bit 6: PGS_CBP_Sat_CB_Vector() returned PGSCBP_E_INVALID_CB_ID; bit 7: PGS_CBP_Sat_CB_Vector() returned PGSMEM_E_NO_MEMORY; bit 8: PGS_CBP_Sat_CB_Vector() returned PGSCBP_E_UNABLE_TO_OPEN_FILE; bit 9: PGS_CBP_Sat_CB_Vector() returned PGSTD_E_BAD_INITIAL_TIME; bit 10: PGS_CBP_Sat_CB_Vector() returned PGSCBP_E_TIME_OUT_OF_RANGE; bit 11: PGS_CBP_Sat_CB_Vector() returned PGSTD_E_SC_TAG_UNKNOWN; bit 12: PGS_CBP_Sat_CB_Vector() returned PGSEPH_E_BAD_EPHEM_FILE_HDR; bit 13: PGS_CBP_Sat_CB_Vector() returned PGSEPH_E_NO_SC_EPHEM_FILE; bit 14:

			PGS_CBP_Sat_CB_Vector() returned PGS_E_TOOLKIT; bit 15: not used
nadirTAI	64-bit floating-point	None	TAI time at which instrument is nominally looking directly down. (between footprints 15 & 16 for AMSU or between footprints 45 & 46 for AIRS/Vis & HSB) (floating-point elapsed seconds since start of 1993)
sat_lat	64-bit floating-point	None	Satellite geodetic latitude in degrees North (-90.0 ... 90.0)
sat_lon	64-bit floating-point	None	Satellite geodetic longitude in degrees East (-180.0 ... 180.0)
scan_node_type	8-bit integer	None	'A' for ascending, 'D' for descending, 'N' for North-Polar, 'S' for South-Polar
glintlat	32-bit floating-point	None	Solar glint geodetic latitude in degrees North at nadirTAI (-90.0 ... 90.0)
glintlon	32-bit floating-point	None	Solar glint geodetic longitude in degrees East at nadirTAI (-180.0 ... 180.0)

Size: 2565 bytes (0.0 MB) per 45-scanset granule

## Full Swath Data Fields

These fields appear for every footprint of every scanline in the granule (GeoTrack \* GeoXTrack times)

Name	Type	Extra Dimensions	Explanation
RetQAFlag	16-bit unsigned integer	None	Retrieval QA flags: users are advised not to use unless all bits are zero. bits 10-15: spare, set to zero.; bit 9 (value 512): retrieved ocean SST disagrees with NCEP forecast by at least 3 K; bit 8 (value 256): This record type not yet validated; bits 5-7: spare, set to zero; bit 4 (value 16): Final retrieval rejected or not attempted; bit 3 (value 8): Final Cloud Clearing rejected or not attempted; bit 2 (value 4): Regression First Guess rejected or not attempted; bit 1 (value 2): Initial Cloud Clearing rejected or not attempted; bit 0 (LSB, value 1): MW retrieval rejected or not attempted
radiances	32-bit floating-point	Channel (= 2378)	Cloud-cleared radiances for each channel in milliWatts/m**2/cm**-1/steradian
radiance_err	32-bit floating-point	Channel (= 2378)	Error estimate for radiances (milliWatts/m**2/cm**-1/steradian)
scanang	32-bit floating-point	None	Scanning angle of AIRS instrument with respect to the spacecraft for this footprint (-180.0 ... 180.0, negative at start of scan, 0 at nadir)
ftptgeoqa	32-bit unsigned integer	None	Footprint Geolocation QA flags: bit 0 (LSB): bad input value; bit 1: PGS_TD_TAItoUTC() returned PGSTD_E_NO_LEAP_SECS; bit 2: PGS_TD_TAItoUTC() returned PGS_E_TOOLKIT; bit 3: PGS_CSC_GetFOV_Pixel() returned PGSCSC_W_MISS_EARTH; bit 4: PGS_CSC_GetFOV_Pixel() returned PGSTD_E_SC_TAG_UNKNOWN; bit 5: PGS_CSC_GetFOV_Pixel() returned PGSCSC_W_ZERO_PIXEL_VECTOR; bit 6: PGS_CSC_GetFOV_Pixel() returned PGSCSC_W_BAD_EPH_FOR_PIXEL; bit 7: PGS_CSC_GetFOV_Pixel() returned PGSCSC_W_INSTRUMENT_OFF_BOARD; bit 8: PGS_CSC_GetFOV_Pixel() returned PGSCSC_W_BAD_ACCURACY_FLAG; bit 9: PGS_CSC_GetFOV_Pixel() returned PGSCSC_E_BAD_ARRAY_SIZE; bit 10: PGS_CSC_GetFOV_Pixel() returned PGSCSC_W_DEFAULT_EARTH_MODEL; bit 11: PGS_CSC_GetFOV_Pixel() returned PGSCSC_W_DATA_FILE_MISSING; bit 12: PGS_CSC_GetFOV_Pixel() returned PGSCSC_E_NEG_OR_ZERO_RAD; bit 13: PGS_CSC_GetFOV_Pixel() returned PGSMEM_E_NO_MEMORY; bit 14: PGS_CSC_GetFOV_Pixel() returned PGSTD_E_NO_LEAP_SECS; bit 15: PGS_CSC_GetFOV_Pixel() returned PGSTD_E_TIME_FMT_ERROR; bit 16: PGS_CSC_GetFOV_Pixel() returned PGSTD_E_TIME_VALUE_ERROR; bit 17: PGS_CSC_GetFOV_Pixel() returned PGSCSC_W_PREDICTED_UT1; bit 18: PGS_CSC_GetFOV_Pixel() returned PGSTD_E_NO_UT1_VALUE; bit 19: PGS_CSC_GetFOV_Pixel() returned PGS_E_TOOLKIT; bit 20: PGS_CSC_GetFOV_Pixel() returned PGSEPH_E_BAD_EPHEM_FILE_HDR; bit 21: PGS_CSC_GetFOV_Pixel() returned PGSEPH_E_NO_SC_EPHEM_FILE; bit 22-31: not used
zengeoqa	16-bit unsigned integer	None	Satellite zenith Geolocation QA flags: bit 0 (LSB): (Spacecraft) bad input value; bit 1: PGS_CSC_ZenithAzimuth(S/C) returned PGSCSC_W_BELOW_HORIZON; bit 2: PGS_CSC_ZenithAzimuth(S/C) returned PGSCSC_W_UNDEFINED_AZIMUTH; bit 3: PGS_CSC_ZenithAzimuth(S/C) returned PGSCSC_W_NO_REFRACTION; bit 4: PGS_CSC_ZenithAzimuth(S/C) returned PGSCSC_E_INVALID_VECTAG; bit 5: PGS_CSC_ZenithAzimuth(S/C) returned PGSCSC_E_LOOK_PT_ALTIT_RANGE; bit 6: PGS_CSC_ZenithAzimuth(S/C) returned PGSCSC_E_ZERO_INPUT_VECTOR; bit 7: PGS_CSC_ZenithAzimuth(S/C) returned PGS_E_TOOLKIT; bit 8: (Sun) bad input value; bit 9: (suppressed) PGS_CSC_ZenithAzimuth(Sun) returned PGSCSC_W_BELOW_HORIZON (This is not an error condition - the sun is below the horizon at night); bit 10: PGS_CSC_ZenithAzimuth(Sun) returned PGSCSC_W_UNDEFINED_AZIMUTH; bit 11: PGS_CSC_ZenithAzimuth(Sun) returned PGSCSC_W_NO_REFRACTION; bit 12: PGS_CSC_ZenithAzimuth(Sun) returned PGSCSC_E_INVALID_VECTAG; bit 13: PGS_CSC_ZenithAzimuth(Sun) returned PGSCSC_E_LOOK_PT_ALTIT_RANGE; bit 14: PGS_CSC_ZenithAzimuth(Sun) returned PGSCSC_E_ZERO_INPUT_VECTOR; bit 15: PGS_CSC_ZenithAzimuth(Sun) returned PGS_E_TOOLKIT
demgeoqa	16-bit unsigned integer	None	Digital Elevation Model (DEM) Geolocation QA flags: bit 0 (LSB): bad input value; bit 1: Could not allocate memory; bit 2: Too close to North or South pole. Excluded; bit 3: Layer resolution incompatibility. Excluded; bit 4: Any DEM Routine (elev) returned PGSDDEM_E_IMPROPER_TAG; bit 5: Any DEM Routine (elev) returned PGSDDEM_E_CANNOT_ACCESS_DATA; bit 6: Any DEM Routine (land/water) returned PGSDDEM_E_IMPROPER_TAG; bit 7: Any DEM Routine (land/water) returned PGSDDEM_E_CANNOT_ACCESS_DATA; bit 8: Reserved for future layers; bit 9: Reserved for future layers; bit 10: PGS_DEM_GetRegion(elev) returned

			PGSDEM_M_FILLVALUE_INCLUDED; bit 11: PGS_DEM_GetRegion(land/water) returned PGSDEM_M_FILLVALUE_INCLUDED; bit 12: Reserved for future layers; bit 13: PGS_DEM_GetRegion(all) returned PGSDEM_M_MULTIPLE_RESOLUTIONS; bit 14: PGS_CSC_GetFOV_Pixel() returned any 'W' class return code except PGSCSC_W_PREDICTED_UT1; bit 15: PGS_CSC_GetFOV_Pixel() returned any 'E' class return code
satzen	32-bit floating-point	None	Spacecraft zenith angle (0.0 ... 180.0) degrees from zenith (measured relative to the geodetic vertical on the reference (WGS84) spheroid and including corrections outlined in EOS SDP toolkit for normal accuracy.)
satazi	32-bit floating-point	None	Spacecraft azimuth angle (-180.0 ... 180.0) degrees E of N GEO)
solzen	32-bit floating-point	None	Solar zenith angle (0.0 ... 180.0) degrees from zenith (measured relative to the geodetic vertical on the reference (WGS84) spheroid and including corrections outlined in EOS SDP toolkit for normal accuracy.)
solazi	32-bit floating-point	None	Solar azimuth angle (-180.0 ... 180.0) degrees E of N GEO)
sun_glint_distance	16-bit integer	None	Distance (km) from footprint center to location of the sun glint (-9999 for unknown, 30000 for no glint visible because spacecraft is in Earth's shadow)
topog	32-bit floating-point	None	Mean topography in meters above reference ellipsoid
topog_err	32-bit floating-point	None	Error estimate for topog
landFrac	32-bit floating-point	None	Fraction of spot that is land (0.0 ... 1.0)
landFrac_err	32-bit floating-point	None	Error estimate for landFrac
invalid	8-bit integer	None	No valid output (1: True, 0: False, 255/-1: Unknown)
clear_flag	8-bit integer	None	1 for 100% clear, 0 for
MW_ret_used	8-bit integer	None	MW-only final retrieval used (1: True, 0: False, 255/-1: Unknown)
retrieval_type	8-bit integer	None	Deprecated -- use RetQAFlag. Retrieval type: 0 for full retrieval; 10 for MW + final succeeded, initial retrieval failed; 20 for MW + initial succeeded, final failed; 30 for only MW stage succeeded, initial + final retrieval failed; 40 for MW + initial succeeded, final cloud-clearing failed; 50 for only MW stage succeeded, initial + final cloud-clearing failed; 100 for no retrieval;

Size: 25752600 bytes (25.8 MB) per 45-scanset granule

**Total File Size (plus storage for dimensions and other HDF-EOS overhead):  
25797258 bytes (25.8 MB) per 45-scanset granule = 6191.3 MB per day**

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## A-9. L2 Support Atmospheric/Surface Product Interface Specification

Interface Specification Version 3.0.4.0  
2003-05-19

ESDT ShortName = "AIRX2SUP"

Swath Name = "L2\_Support\_atmospheric&surface\_product"

Level = "level2"

# Footprints = 30

# scanlines per scanset = 1

### Dimensions

These fields define all dimensions that can be used for HDF-EOS swath fields.

The names "GeoTrack" and "GeoXTrack" have a special meaning for this document: "Cross-Track" data fields have a hidden dimension of "GeoXTrack"; "Along-Track" data fields have a hidden dimension of "GeoTrack"; "Full Swath Data Fields have hidden dimensions of both "GeoTrack" and "GeoXTrack".

Name	Value	Explanation
GeoXTrack	30	Dimension across track for footprint positions. Same as number of footprints per scanline. -- starting at the left and increasing towards the right as you look along the satellite's path
GeoTrack	# of scan lines in swath	Dimension along track for footprint positions. Same as number of scanlines in granule. Parallel to the satellite's path, increasing with time. (Nominally 45 for Level-2, AMSU-A, and AIRS/Vis low-rate engineering; 135 for AIRS/Vis and HSB high-rate quantities)
StdPressureLev	28	Number of standard pressure altitude levels (from bottom of the atmosphere up)
StdPressureLay	28	Number of standard pressure altitude layers (Always equal to StdPressureLev: last layer goes from level 1 to the top of the atmosphere)
AIRSXTrack	3	The number of AIRS cross-track spots per AMSU-A spot. Direction is the same as GeoXTrack -- starting at the left and increasing towards the right as you look along the satellite's path
AIRSTrack	3	The number of AIRS along-track spots per AMSU-A spot. Direction is the same as GeoTrack -- parallel to the satellite's path, increasing with time
Cloud	2	Cloud layer dimension in order of increasing pressure. Only first numCloud elements are valid
ChanAMSUA	15	Dimension of AMSU-A Channel array (Channel 1: 23.8 GHz; Ch 2: 31.4 GHz; Ch 3: 50.3 GHz; Ch 4: 52.8 GHz; Ch 5: 53.596 +/- 0.115 GHz; Ch 6: 54.4 GHz; Ch 7: 54.94 GHz; Ch 8: 55.5 GHz; Ch 9: f0; Ch 10: f0 +/- 0.217 GHz Ch 11: f0 +/- df +/- 48 MHz; Ch 12: f0 +/- df +/- 22 MHz; Ch 13: f0 +/- df +/- 10 MHz; Ch 14: f0 +/- df +/- 4.5 MHz; Ch 15: 89 GHz (f0 = 57290.344 MHz; df = 322.4 MHz))
ChanHSB	5	Dimension of HSB Channel array (Channel 1: Deleted 89.0 GHz channel: always invalid; Ch 2: 150.0 GHz; Ch 3: f0 +/- 1.0 GHz; Ch 4: f0 +/- 3.0 GHz; Ch 5: f0 +/- 7.0 GHz (f0 = 183.31 GHz))
MWHingeSurf	7	Number of standard frequency hinge points in Microwave surface emissivity and surface brightness. Frequencies are 23.8, 31.4, 50.3, 52.8, 89.0, 150.0, 183.3 GHz respectively.
XtraPressureLev	100	Number of pressure altitude layers in high vertical resolution support products (from top of the atmosphere down)
XtraPressureLay	100	Number of pressure altitude layers in high vertical resolution support products (Always equal to XtraPressureLev: first layer goes from the top of the atmosphere to level 1)
HingeCloud	7	Frequency hinge points in cloud emissivity in order of increasing frequency. Only first numHingeCloud elements are valid
HingeSurfInIt	50	Maximum number of frequency hinge points in IR surface emissivity from initial regression
VisXTrack	8	The number of Vis cross-track spots per AIRS. Direction is the same as GeoXTrack & AIRSXTrack -- starting at the left and increasing towards the right as you look along the satellite's path
VisTrack	9	The number of Vis along-track spots per AIRS. Direction is the same as GeoTrack & AIRSTrack -- parallel to the satellite's path, increasing with time. (opposite order to detector ordering -- detector 0 is last)
VChn	4	The number of Visible channels
ScoresBand	10	The number of IR frequency bands for which Initial_CC subscores are calculated. Band limits are (in cm^-1): 645., 704., 800., 1000., 1200., 2200., 2304., 2382., 2390., 2400., 2600.
CCTest	10	The number of cloud-clearing tests
VisGeoSpots	4	Geolocations for the 4 corner pixels in the order: trailing first scanned; trailing last-scanned; leading first-scanned; leading last-scanned. Each footprint also has a central geolocation associated with the swath geolocation lat/lon/time of the footprint.

## Geolocation Fields

These fields appear for every footprint (GeoTrack \* GeoXTrack times) and correspond to footprint center coordinates and "shutter" time.

Name	Explanation
Latitude	Footprint boresight geodetic Latitude in degrees North (-90.0 ... 90.0)
Longitude	Footprint boresight geodetic Longitude in degrees East (-180.0 ... 180.0)
Time	Footprint "shutter" TAI Time: floating-point elapsed seconds since Jan 1, 1993

Size: 32400 bytes (0.0 MB) per 45-scanset granule

## Attributes

These fields appear only once per granule

Name	Type	Extra Dimensions	Explanation
processing_level	string of 8-bit characters	None	Zero-terminated character string denoting processing level ("level2")
instrument	string of 8-bit characters	None	Zero-terminated character string denoting instrument ("AIRS")
DayNightFlag	string of 8-bit characters	None	Zero-terminated character string denoting granule as day and/or night: (Always "Day", "Night", or "Both")
AutomaticQAFlag	string of 8-bit characters	None	Zero-terminated character string denoting granule data quality: (Always "Passed", "Failed", or "Suspect")
NumTotalData	32-bit integer	None	Total number of expected scene footprints
NumProcessData	32-bit integer	None	Number of scene footprints which are present and can be processed routinely (state = 0)
NumSpecialData	32-bit integer	None	Number of scene footprints which are present and can be processed only as a special test (state = 1)
NumBadData	32-bit integer	None	Number of scene footprints which are present but cannot be processed (state = 2)
NumMissingData	32-bit integer	None	Number of expected scene footprints which are not present (state = 3)
NumLandSurface	32-bit integer	None	Number of scene footprints for which the surface is more than 90% land
NumOceanSurface	32-bit integer	None	Number of scene footprints for which the surface is less than 10% land
node_type	string of 8-bit characters	None	Zero-terminated character string denoting whether granule is ascending, descending, or pole-crossing: ("Ascending" and "Descending" for entirely ascending or entirely descending granules, or "NorthPole" or "SouthPole" for pole-crossing granules)
start_year	32-bit integer	None	Year in which granule started, UTC (e.g. 1999)
start_month	32-bit integer	None	Month in which granule started, UTC (1 ... 12)
start_day	32-bit integer	None	Day of month in which granule started, UTC (1 ... 31)
start_hour	32-bit integer	None	Hour of day in which granule started, UTC (0 ... 23)
start_minute	32-bit integer	None	Minute of hour in which granule started, UTC (0 ... 59)
start_sec	32-bit floating-point	None	Second of minute in which granule started, UTC (0.0 ... 59.0)
start_orbit	32-bit integer	None	Orbit number of mission in which granule started
end_orbit	32-bit integer	None	Orbit number of mission in which granule ended
orbit_path	32-bit integer	None	Orbit path of start orbit (1 ... 233 as defined by EOS project)
start_orbit_row	32-bit integer	None	Orbit row at start of granule (1 ... 248 as defined by EOS project)
end_orbit_row	32-bit integer	None	Orbit row at end of granule (1 ... 248 as defined by EOS project)
granule_number	32-bit integer	None	Number of granule within day (1 ... 240)
num_scansets	32-bit integer	None	Number of scansets in granule (1 ... 45)
num_scanlines	32-bit integer	None	Number of scanlines in granule (1 * num_scansets)
start_Latitude	64-bit floating-point	None	Geodetic Latitude of spacecraft at start of granule in degrees North (-90.0 ... 90.0)
start_Longitude	64-bit floating-point	None	Geodetic Longitude of spacecraft at start of granule in degrees East (-180.0 ... 180.0)
start_Time	64-bit floating-point	None	TAI Time at start of granule (floating-point elapsed seconds since start of 1993)
end_Latitude	64-bit floating-point	None	Geodetic Latitude of spacecraft at end of granule in degrees North (-90.0 ... 90.0)

end_Longitude	64-bit floating-point	None	Geodetic Longitude of spacecraft at end of granule in degrees East (-180.0 ... 180.0)
end_Time	64-bit floating-point	None	TAI Time at end of granule (floating-point elapsed seconds since start of 1993)
eq_x_longitude	32-bit floating-point	None	Longitude of spacecraft at southward equator crossing nearest granule start in degrees East (-180.0 ... 180.0)
eq_x_tai	64-bit floating-point	None	Time of eq_x_longitude in TAI units (floating-point elapsed seconds since start of 1993)
orbitgeoqa	32-bit unsigned integer	None	Orbit Geolocation QA: bit 0 (LSB): bad input value (last scanline); bit 1: bad input value (first scanline); bit 2: PGS_EPH_GetEphMet() returned PGSEPH_E_NO_SC_EPHEM_FILE; bit 3: PGS_EPH_GetEphMet() returned PGSEPH_E_BAD_ARRAY_SIZE; bit 4: PGS_EPH_GetEphMet() returned PGSTD_E_TIME_FMT_ERROR; bit 5: PGS_EPH_GetEphMet() returned PGSTD_E_TIME_VALUE_ERROR; bit 6: PGS_EPH_GetEphMet() returned PGSTD_E_SC_TAG_UNKNOWN; bit 7: PGS_EPH_GetEphMet() returned PGS_E_TOOLKIT; bit 8: PGS_TD_UTCtoTAI() returned PGSTD_E_NO_LEAP_SECS; bit 9: PGS_TD_UTCtoTAI() returned PGSTD_E_TIME_FMT_ERROR; bit 10: PGS_TD_UTCtoTAI() returned PGSTD_E_TIME_VALUE_ERROR; bit 11: PGS_TD_UTCtoTAI() returned PGS_E_TOOLKIT; bit 12: PGS_CSC_DayNight() returned PGSTD_E_NO_LEAP_SECS; bit 13: PGS_CSC_DayNight() returned PGSCSC_E_INVALID_LIMITTAG; bit 14: PGS_CSC_DayNight() returned PGSCSC_E_BAD_ARRAY_SIZE; bit 15: PGS_CSC_DayNight() returned PGSCSC_W_ERROR_IN_DAYNIGHT; bit 16: PGS_CSC_DayNight() returned PGSCSC_W_BAD_TRANSFORM_VALUE; bit 17: PGS_CSC_DayNight() returned PGSCSC_W_BELOW_HORIZON; bit 18: PGS_CSC_DayNight() returned PGSTD_E_NO_UT1_VALUE; bit 19: PGS_CSC_DayNight() returned PGSTD_E_BAD_INITIAL_TIME; bit 20: PGS_CSC_DayNight() returned PGSCBP_E_TIME_OUT_OF_RANGE; bit 21: PGS_CSC_DayNight() returned PGSCBP_E_UNABLE_TO_OPEN_FILE; bit 22: PGS_CSC_DayNight() returned PGSMEM_E_NO_MEMORY; bit 23: PGS_CSC_DayNight() returned PGS_E_TOOLKIT; bit 25-31: not used
num_satgeoqa	16-bit integer	None	Number of scans with problems in satgeoqa
num_glintgeoqa	16-bit integer	None	Number of scans with problems in glintgeoqa
num_moongoqa	16-bit integer	None	Number of scans with problems in moongoqa
num_ftptgeoqa	16-bit integer	None	Number of footprints with problems in ftptgeoqa
num_zengeqa	16-bit integer	None	Number of footprints with problems in zengeqa
num_demgeoqa	16-bit integer	None	Number of footprints with problems in demgeoqa
num_fpe	16-bit integer	None	Number of floating point errors
LonGranuleCen	16-bit integer	None	Geodetic Longitude of the center of the granule in degrees East (-180 ... 180)
LatGranuleCen	16-bit integer	None	Geodetic Latitude of the center of the granule in degrees North (-90 ... 90)
LocTimeGranuleCen	16-bit integer	None	Local solar time at the center of the granule in minutes past midnight (0 ... 1439)
pressSupp	32-bit floating-point	XtraPressureLev (= 100)	Support pressures (lower boundary) in mb
numHingeSurfInit	32-bit integer	None	Number of IR hinge points for surface emissivity and reflectivity from initial regression
freqEmisInit	32-bit floating-point	HingeSurfInit (= 50)	Frequencies for surface emissivity and reflectivity in cm-1 (in order of increasing frequency. Only first numHingeSurfInit elements are valid)
rhoVisErr	8-bit integer	VisTrack (= 9) * VChn (= 4)	Error estimate for rhoVis
num_invalid	16-bit integer	None	# of footprints where invalid is True
num_clear_flag	16-bit integer	None	# of footprints 100% clear
num_MW_ret_used	16-bit integer	None	# of footprints where MW-only final retrieval used
num_retrieval_type	16-bit integer	None	# of footprints without full retrieval
num_bad_l1b	16-bit integer	None	# of footprints with Level 2 process not allowed due to bad level 1b data
num_bad_l1b_amsu	16-bit integer	None	# of footprints with Bad AMSU-A level 1b data
num_bad_l1b_hsb	16-bit integer	None	# of footprints with Bad HSB level 1b data
num_bad_l1b_airs	16-bit integer	None	# of footprints with Bad AIRS level 1b data
num_bad_l1b_vis	16-bit integer	None	# of footprints with Bad VIS level 1b data
num_forecast	16-bit integer	None	# of footprints where Complete forecast guess was used
num_no_psurf_guess	16-bit integer	None	# of footprints where No surface pressure was available. Topography was used for surf press
num_bad_temps	16-bit integer	None	# of footprints with invalid temp and surface skin temp

num_bad_h2o	16-bit integer	None	# of footprints with invalid water vapor profile
num_bad_o3	16-bit integer	None	# of footprints with invalid ozone profile
num_bad_clouds	16-bit integer	None	# of footprints with invalid cloud parameters
num_bad_low_atm	16-bit integer	None	# of footprints with invalid result below 100 mb
num_no_tuning	16-bit integer	None	# of footprints with Standard br temp tuning NOT applied
num_no_ang_corr	16-bit integer	None	# of footprints with Standard angle correction NOT applied
num_no_mw	16-bit integer	None	# of footprints with MW only retrieval not attempted
num_no_initial	16-bit integer	None	# of footprints with First retrieval not attempted
num_no_final	16-bit integer	None	# of footprints with Final retrieval not attempted
num_mw_fpe	16-bit integer	None	# of footprints with floating-point exception in MW retrieval step
num_initial_fpe	16-bit integer	None	# of footprints with floating-point exception in Initial retrieval step
num_final_fpe	16-bit integer	None	# of footprints with floating-point exception in Final retrieval step
num_MWPrecip	16-bit integer	None	# of footprints where Precipitation was detected over 0.5 mm/hr
num_precipAA4_50km	16-bit integer	None	# of footprints with nonzero precipitation correction in AMSU-A channel 4
num_precipAA5_50km	16-bit integer	None	# of footprints with nonzero precipitation correction in AMSU-A channel 5
num_precipAA6_50km	16-bit integer	None	# of footprints with nonzero precipitation correction in AMSU-A channel 6
num_precipAA7_50km	16-bit integer	None	# of footprints with nonzero precipitation correction in AMSU-A channel 7
num_precipAA8_50km	16-bit integer	None	# of footprints with nonzero precipitation correction in AMSU-A channel 8
num_precipAA9_50km	16-bit integer	None	# of footprints with nonzero precipitation correction in AMSU-A channel 9
stat_aa4_precip_corr_50km	Unlimited Engineering Struct (see below)	None	Statistics of precipitation correction for AMSU-A channel 4 (Kelvins)
stat_aa5_precip_corr_50km	Unlimited Engineering Struct (see below)	None	Statistics of precipitation correction for AMSU-A channel 5 (Kelvins)
stat_aa6_precip_corr_50km	Unlimited Engineering Struct (see below)	None	Statistics of precipitation correction for AMSU-A channel 6 (Kelvins)
stat_aa7_precip_corr_50km	Unlimited Engineering Struct (see below)	None	Statistics of precipitation correction for AMSU-A channel 7 (Kelvins)
stat_aa8_precip_corr_50km	Unlimited Engineering Struct (see below)	None	Statistics of precipitation correction for AMSU-A channel 8 (Kelvins)
stat_aa9_precip_corr_50km	Unlimited Engineering Struct (see below)	None	Statistics of precipitation correction for AMSU-A channel 9 (Kelvins)
stat_rain_rate_50km	Unlimited Engineering Struct (see below)	None	Statistics of rain rate (mm/hr)
stat_MWsurf_R0	Unlimited Engineering Struct (see below)	None	Statistics of internal adjustment parameter -- surface R0
stat_MWsurf_T0	Unlimited Engineering Struct (see below)	None	Statistics of internal adjustment parameter -- surface T0
stat_MWsurf_Tinf	Unlimited Engineering Struct (see below)	None	Statistics of internal adjustment parameter -- surface Tinfinity
stat_MWseice_conc	Unlimited Engineering Struct (see below)	None	Statistics of ice or snow concentration (0-1)
stat_MWresidual_temp	Limited Engineering	None	Statistics of sum of squares of temperature residuals normalized by channel sensitivities

	Struct (see below)		
stat_MWresidual_mois	Limited Engineering Struct (see below)	None	Statistics of sum of squares of moisture residuals normalized by channel sensitivities
stat_MWresidual_AMSUA	Unlimited Engineering Struct (see below)	ChanAMSUA (= 15)	Statistics of Brightness temperature residual for each AMSU-A channel (Kelvin)
stat_MWresidual_HSB	Unlimited Engineering Struct (see below)	ChanHSB (= 5)	Statistics of brightness temperature residual for each HSB channel (Kelvin)
stat_MWiter_temp	Unlimited Engineering Struct (see below)	None	Statistics of # of iterations of the temperature profile
stat_MWiter_mois	Unlimited Engineering Struct (see below)	None	Statistics of # of iterations of the moisture profile
num_mw_ret_code	16-bit integer	None	Return code status of MW retrieval not zero
num_cloud_ice	16-bit integer	None	# of footprints with Scattering by cloud ice present in FOV
num_icc_too_cloudy	16-bit integer	None	# of footprints with Initial cloud clearing pass too cloudy
num_icc_low_contrast	16-bit integer	None	# of footprints with Initial cloud clearing pass contrast too low
num_icc_bad_rad	16-bit integer	None	# of footprints with Initial cloud clearing pass cloud cleared radiances do not match clear guess - reject the IR retrieval
stat_icc_percent_cld	Unlimited Engineering Struct (see below)	None	Statistics of Initial cloud clearing cloudy percent
stat_icc_contrast	Unlimited Engineering Struct (see below)	None	Statistics of Initial cloud clearing contrast (units?)
num_bad_1st	16-bit integer	None	# of footprints where The initial retrieval failed
num_bad_1st_cc	16-bit integer	None	# of footprints where The first cloud clearing failed
num_bad_1st_regres	16-bit integer	None	# of footprints where The regression guess failed
num_bad_1st_phys	16-bit integer	None	# of footprints where The first physical retrieval failed
num_fcc_too_cloudy	16-bit integer	None	# of footprints where Final cloud clearing pass too cloudy
num_fcc_low_contrast	16-bit integer	None	# of footprints where Final cloud clearing pass contrast too low
num_fcc_bad_rad	16-bit integer	None	# of footprints where Final cloud clearing pass cloud cleared radiances do not match clear guess - reject the IR retrieval
stat_fcc_percent_cld1	Unlimited Engineering Struct (see below)	None	Statistics of Final cloud clearing cloudy percent pass 1
stat_fcc_percent_cld2	Unlimited Engineering Struct (see below)	None	Statistics of Final cloud clearing cloudy percent pass 2
stat_fcc_contrast1	Unlimited Engineering Struct (see below)	None	Statistics of Final cloud clearing contrast (units?) pass 1
stat_fcc_contrast2	Unlimited Engineering Struct (see below)	None	Statistics of Final cloud clearing contrast (units?) pass 2
num_bad_final	16-bit integer	None	# of footprints where Final retrieval failed
num_bad_final_cc	16-bit integer	None	# of footprints where final cloud clearing failed
num_bad_final_ir	16-bit integer	None	# of footprints where final IR retrieval failed
num_bad_final_surf	16-bit integer	None	# of footprints where final surface ret failed
num_bad_final_temp	16-bit integer	None	# of footprints where final temp ret failed
num_bad_final_h2o	16-bit integer	None	# of footprints where final water vapor ret failed

num_bad_final_o3	16-bit integer	None	# of footprints where final ozone ret failed
num_bad_final_cloud	16-bit integer	None	# of footprints where final cloud ret failed
num_bad_cc_cld_ret	16-bit integer	None	# of footprints where Cloud clearing and cloud ret are inconsistent
num_MW_IR_ret_differ	16-bit integer	None	# of footprints where Microwave and IR temperature retrieval differ too much - reject final IR retrieval
num_bad_MW_low_resid	16-bit integer	None	# of footprints with Microwave residuals in lower atmosphere too large - reject final IR retrieval
stat_MW_low_atm_resid	Unlimited Engineering Struct (see below)	None	Statistics of MW residual for lower atmosphere after final retrieval
num_final_AMSU_ret	16-bit integer	None	# of footprints with nonzero final_AMSU_ret
num_final_HSB_ret	16-bit integer	None	# of footprints with nonzero final_HSB_ret
num_final_cloud_ret	16-bit integer	None	# of footprints with nonzero final_cloud_ret
num_final_surf_ret	16-bit integer	None	# of footprints with nonzero final_surf_ret
num_final_temp_ret	16-bit integer	None	# of footprints with nonzero final_temp_ret
num_final_h2o_ret	16-bit integer	None	# of footprints with nonzero final_h2o_ret
num_final_o3_ret	16-bit integer	None	# of footprints with nonzero final_o3_ret
num_final_ch4_ret	16-bit integer	None	# of footprints with nonzero final_ch4_ret
num_final_co_ret	16-bit integer	None	# of footprints with nonzero final_co_ret
num_final_co2_ret	16-bit integer	None	# of footprints with nonzero final_co2_ret
num_low_sun	16-bit integer	None	# of footprints with solar zenith angle > 60 degrees
num_wide_ang	16-bit integer	None	# of footprints with viewing angle at center of AIRS spot > 50 degrees
num_vis_glnt	16-bit integer	None	# of footprints with sun-glnt is expected to alter radiances for any water surfaces in the AMSU FOV by at least 5%. (No test is made, however, for whether any water is actually located within the FOV.)
num_bad_vis_rad	16-bit integer	None	# of footprints with Vis/NIR radiance out of range
num_bad_vis_cal	16-bit integer	None	# of footprints with Vis/NIR calibration data old or invalid
num_bad_vis_det_temp	16-bit integer	None	# of footprints with Vis/NIR Detector temperature out of range
num_bad_scan_hd_temp	16-bit integer	None	# of footprints with Scan Head Assembly temperature out of range
num_bad_vis_cld_det	16-bit integer	None	# of footprints with Cloud detection failed
num_bad_vis_cld_hgt	16-bit integer	None	# of footprints with Cloud height failed
num_bad_ref_NDVI	16-bit integer	None	# of footprints with Bad reference Normalized Differential Vegetation Index
num_bad_vis_var	16-bit integer	None	# of footprints with Variability index invalid
num_vis_clear	16-bit integer	None	# of footprints where at least 97.2% of each IR FOV within the AMSU FOV is clear sky
num_vis_cloudy	16-bit integer	None	# of footprints with at least 79.2% of each IR FOV within the AMSU FOV is cloudy
num_vis_low_cloud	16-bit integer	None	# of footprints with at least 79.2% of each IR FOV within the AMSU FOV is low_cloud
stat_Initial_CC_score	Unlimited Engineering Struct (see below)	None	Statistics of Indicator of how well the initial cloud-cleared radiances match radiances reconstructed from clear eigenvectors. (0.0 for a perfect match; 10.0 indicates a major problem)
stat_Initial_CC_subscores	Unlimited Engineering Struct (see below)	ScoresBand (= 10)	Statistics of Sub-scores contributing to Initial_CC_score, by frequency band
NumVisInvalid	32-bit integer	None	Number of profiles in which L2 Vis processing encountered a problem
NumMWStratIrRetOnly	32-bit integer	None	Number of profiles in which the final product comes only from MW and stratospheric IR information (retrieval_types 20, 30, 40)
NumNoHSB	32-bit integer	None	Number of retrieval profiles for which no HSB input data is used
NumNoAMSUA	32-bit integer	None	Number of retrieval profiles for which no AMSU-A input data is used
NumNoAIRS	32-bit integer	None	Number of retrieval profiles for which no AIRS-IR input data is used
NumNoVis	32-bit integer	None	Number of retrieval profiles for which no AIRS-V/NIR input data is used
DCRCount	32-bit integer	None	Number of times a Direct Current Restore was executed for any module
PopCount	32-bit integer	None	Number of popcorn events within granule, i.e. number of times than an AIRS channel used in the Level 2 retrieval has suffered a sudden discontinuity in

			dark current
MoonInViewMWCount	32-bit integer	None	Number of scanlines in granule with the moon in a Microwave space view (approx)
VegMapFileName	string of 8-bit characters	None	Name of input file used as Vegetation Map

Size: 4022 bytes (0.0 MB) per granule

## Along-Track Data Fields

These fields appear once per scanline (GeoTrack times)

Name	Type	Extra Dimensions	Explanation
satheight	32-bit floating-point	None	Satellite altitude at nadirTAI in km above reference ellipsoid (e.g. 725.2)
satroll	32-bit floating-point	None	Satellite attitude roll angle at nadirTAI (-180.0 ... 180.0 angle about the +x (roll) ORB axis, +x axis is positively oriented in the direction of orbital flight completing an orthogonal triad with y and z.)
satpitch	32-bit floating-point	None	Satellite attitude pitch angle at nadirTAI (-180.0 ... 180.0 angle about +y (pitch) ORB axis. +y axis is oriented normal to the orbit plane with the positive sense opposite to that of the orbit's angular momentum vector H.)
satyaw	32-bit floating-point	None	Satellite attitude yaw angle at nadirTAI (-180.0 ... 180.0 angle about +z (yaw) axis. +z axis is positively oriented earthward parallel to the satellite radius vector R from the spacecraft center of mass to the center of the Earth.)
satgeoqa	32-bit unsigned integer	None	Satellite Geolocation QA flags: bit 0 (LSB): bad input value; bit 1: PGS_TD_TAItUTC() returned PGSTD_E_NO_LEAP_SECS; bit 2: PGS_TD_TAItUTC() returned PGS_E_TOOLKIT; bit 3: PGS_EPH_EphemAttit() returned PGSEPH_E_BAD_EPHEM_VALUE; bit 4: PGS_EPH_EphemAttit() returned PGSEPH_E_BAD_EPHEM_FILE_HDR; bit 5: PGS_EPH_EphemAttit() returned PGSEPH_E_NO_SC_EPHEM_FILE; bit 6: PGS_EPH_EphemAttit() returned PGSEPH_E_NO_DATA_REQUESTED; bit 7: PGS_EPH_EphemAttit() returned PGSTD_E_SC_TAG_UNKNOWN; bit 8: PGS_EPH_EphemAttit() returned PGSEPH_E_BAD_ARRAY_SIZE; bit 9: PGS_EPH_EphemAttit() returned PGSTD_E_TIME_FMT_ERROR; bit 10: PGS_EPH_EphemAttit() returned PGSTD_E_TIME_VALUE_ERROR; bit 11: PGS_EPH_EphemAttit() returned PGSTD_E_NO_LEAP_SECS; bit 12: PGS_EPH_EphemAttit() returned PGS_E_TOOLKIT; bit 13: PGS_CSC_ECItECR() returned PGSCSC_W_BAD_TRANSFORM_VALUE; bit 14: PGS_CSC_ECItECR() returned PGSCSC_E_BAD_ARRAY_SIZE; bit 15: PGS_CSC_ECItECR() returned PGSTD_E_NO_LEAP_SECS; bit 16: PGS_CSC_ECItECR() returned PGSTD_E_TIME_FMT_ERROR; bit 17: PGS_CSC_ECItECR() returned PGSTD_E_TIME_VALUE_ERROR; bit 18: unused (set to zero); bit 19: PGS_CSC_ECItECR() returned PGSTD_E_NO_UT1_VALUE; bit 20: PGS_CSC_ECItECR() returned PGS_E_TOOLKIT; bit 21: PGS_CSC_ECRtoGEO() returned PGSCSC_W_TOO_MANY_ITERS; bit 22: PGS_CSC_ECRtoGEO() returned PGSCSC_W_INVALID_ALTITUDE; bit 23: PGS_CSC_ECRtoGEO() returned PGSCSC_W_SPHERE_BODY; bit 24: PGS_CSC_ECRtoGEO() returned PGSCSC_W_LARGE_FLATTENING; bit 25: PGS_CSC_ECRtoGEO() returned PGSCSC_W_DEFAULT_EARTH_MODEL; bit 26: PGS_CSC_ECRtoGEO() returned PGSCSC_E_BAD_EARTH_MODEL; bit 27: PGS_CSC_ECRtoGEO() returned PGS_E_TOOLKIT; bit 28-31: not used
glintgeoqa	16-bit unsigned integer	None	Glint Geolocation QA flags: bit 0 (LSB): bad input value; bit 1: glint location in Earth's shadow; bit 2: glint calculation not converging; bit 3: glint location sun vs. satellite zenith mismatch; bit 4: glint location sun vs. satellite azimuth mismatch; bit 5: bad glint location; bit 6: PGS_CSC_ZenithAzimuth() returned any 'W' class return code; bit 7: PGS_CSC_ZenithAzimuth() returned any 'E' class return code; bit 8: PGS_CBP_Earth_CB_Vector() returned returned any 'W' class return code; bit 9: PGS_CBP_Earth_CB_Vector() returned returned any 'E' class return code; bit 10: PGS_CSC_ECItECR() returned any 'W' class return code except PGSCSC_W_PREDICTED_UT1 (for Glint); bit 11: PGS_CSC_ECItECR() returned any 'E' class return code (for Glint); bit 12: PGS_CSC_ECRtoGEO() returned any 'W' class return code (for Glint); bit 13: PGS_CSC_ECRtoGEO() returned any 'E' class return code (for Glint); bit 14: PGS_CSC_ECItECR() returned any 'W' class return code except PGSCSC_W_PREDICTED_UT1; bit 15: PGS_CSC_ECItECR() returned any 'E' class return code
moongeoqa	16-bit unsigned integer	None	Moon Geolocation QA flags: bit 0 (LSB): bad input value; bit 1: PGS_TD_TAItUTC() returned PGSTD_E_NO_LEAP_SECS; bit 2: PGS_TD_TAItUTC() returned PGS_E_TOOLKIT; bit 3: PGS_CBP_Sat_CB_Vector() returned PGSCSC_W_BELOW_SURFACE; bit 4: PGS_CBP_Sat_CB_Vector() returned PGSCBP_W_BAD_CB_VECTOR; bit 5: PGS_CBP_Sat_CB_Vector() returned PGSCBP_E_BAD_ARRAY_SIZE; bit 6: PGS_CBP_Sat_CB_Vector() returned PGSCBP_E_INVALID_CB_ID; bit 7: PGS_CBP_Sat_CB_Vector() returned PGSMEM_E_NO_MEMORY; bit 8: PGS_CBP_Sat_CB_Vector() returned PGSCBP_E_UNABLE_TO_OPEN_FILE; bit 9: PGS_CBP_Sat_CB_Vector() returned PGSTD_E_BAD_INITIAL_TIME; bit 10: PGS_CBP_Sat_CB_Vector() returned PGSCBP_E_TIME_OUT_OF_RANGE; bit 11: PGS_CBP_Sat_CB_Vector() returned PGSTD_E_SC_TAG_UNKNOWN; bit 12: PGS_CBP_Sat_CB_Vector() returned PGSEPH_E_BAD_EPHEM_FILE_HDR; bit 13: PGS_CBP_Sat_CB_Vector() returned PGSEPH_E_NO_SC_EPHEM_FILE; bit 14: PGS_CBP_Sat_CB_Vector() returned PGS_E_TOOLKIT; bit 15: not used
nadirTAI	64-bit floating-point	None	TAI time at which instrument is nominally looking directly down. (between footprints 15 & 16 for AMSU or between footprints 45 & 46 for AIRS/Vis & HSB) (floating-point elapsed seconds since start of 1993)
sat_lat	64-bit floatinn-	None	Satellite geodetic latitude in degrees North (-90.0 ... 90.0)

	point		
sat_lon	64-bit floating-point	None	Satellite geodetic longitude in degrees East (-180.0 ... 180.0)
scan_node_type	8-bit integer	None	'A' for ascending, 'D' for descending, 'N' for North-Polar, 'S' for South-Polar
glintlat	32-bit floating-point	None	Solar glint geodetic latitude in degrees North at nadirTAI (-90.0 ... 90.0)
glintlon	32-bit floating-point	None	Solar glint geodetic longitude in degrees East at nadirTAI (-180.0 ... 180.0)

Size: 2565 bytes (0.0 MB) per 45-scanset granule

## Full Swath Data Fields

These fields appear for every footprint of every scanline in the granule (GeoTrack \* GeoXTrack times)

Name	Type	Extra Dimensions	Explanation
RetQAFlag	16-bit unsigned integer	None	Retrieval QA flags: users are advised not to use unless all bits are zero. bits 10-15: spare, set to zero.; bit 9 (value 512): retrieved ocean SST disagrees with NCEP forecast by at least 3 K; bit 8 (value 256): This record type not yet validated; bits 5-7: spare, set to zero; bit 4 (value 16): Final retrieval rejected or not attempted; bit 3 (value 8): Final Cloud Clearing rejected or not attempted; bit 2 (value 4): Regression First Guess rejected or not attempted; bit 1 (value 2): Initial Cloud Clearing rejected or not attempted; bit 0 (LSB, value 1): MW retrieval rejected or not attempted
ftptgeoqa	32-bit unsigned integer	None	Footprint Geolocation QA flags: bit 0 (LSB): bad input value; bit 1: PGS_TD_TAltoUTC() returned PGSTD_E_NO_LEAP_SECS; bit 2: PGS_TD_TAltoUTC() returned PGS_E_TOOLKIT; bit 3: PGS_CSC_GetFOV_Pixel() returned PGSCSC_W_MISS_EARTH; bit 4: PGS_CSC_GetFOV_Pixel() returned PGSTD_E_SC_TAG_UNKNOWN; bit 5: PGS_CSC_GetFOV_Pixel() returned PGSCSC_W_ZERO_PIXEL_VECTOR; bit 6: PGS_CSC_GetFOV_Pixel() returned PGSCSC_W_BAD_EPH_FOR_PIXEL; bit 7: PGS_CSC_GetFOV_Pixel() returned PGSCSC_W_INSTRUMENT_OFF_BOARD; bit 8: PGS_CSC_GetFOV_Pixel() returned PGSCSC_W_BAD_ACCURACY_FLAG; bit 9: PGS_CSC_GetFOV_Pixel() returned PGSCSC_E_BAD_ARRAY_SIZE; bit 10: PGS_CSC_GetFOV_Pixel() returned PGSCSC_W_DEFAULT_EARTH_MODEL; bit 11: PGS_CSC_GetFOV_Pixel() returned PGSCSC_W_DATA_FILE_MISSING; bit 12: PGS_CSC_GetFOV_Pixel() returned PGSCSC_E_NEG_OR_ZERO_RAD; bit 13: PGS_CSC_GetFOV_Pixel() returned PGSMEM_E_NO_MEMORY; bit 14: PGS_CSC_GetFOV_Pixel() returned PGSTD_E_NO_LEAP_SECS; bit 15: PGS_CSC_GetFOV_Pixel() returned PGSTD_E_TIME_FMT_ERROR; bit 16: PGS_CSC_GetFOV_Pixel() returned PGSTD_E_TIME_VALUE_ERROR; bit 17: PGS_CSC_GetFOV_Pixel() returned PGSCSC_W_PREDICTED_UT1; bit 18: PGS_CSC_GetFOV_Pixel() returned PGSTD_E_NO_UT1_VALUE; bit 19: PGS_CSC_GetFOV_Pixel() returned PGS_E_TOOLKIT; bit 20: PGS_CSC_GetFOV_Pixel() returned PGSEPH_E_BAD_EPHEM_FILE_HDR; bit 21: PGS_CSC_GetFOV_Pixel() returned PGSEPH_E_NO_SC_EPHEM_FILE; bit 22-31: not used
zengeoqa	16-bit unsigned integer	None	Satellite zenith Geolocation QA flags: bit 0 (LSB): (Spacecraft) bad input value; bit 1: PGS_CSC_ZenithAzimuth(S/C) returned PGSCSC_W_BELOW_HORIZON; bit 2: PGS_CSC_ZenithAzimuth(S/C) returned PGSCSC_W_UNDEFINED_AZIMUTH; bit 3: PGS_CSC_ZenithAzimuth(S/C) returned PGSCSC_W_NO_REFRACTION; bit 4: PGS_CSC_ZenithAzimuth(S/C) returned PGSCSC_E_INVALID_VECTAG; bit 5: PGS_CSC_ZenithAzimuth(S/C) returned PGSCSC_E_LOOK_PT_ALTIT_RANGE; bit 6: PGS_CSC_ZenithAzimuth(S/C) returned PGSCSC_E_ZERO_INPUT_VECTOR; bit 7: PGS_CSC_ZenithAzimuth(S/C) returned PGS_E_TOOLKIT; bit 8: (Sun) bad input value; bit 9: (suppressed) PGS_CSC_ZenithAzimuth(Sun) returned PGSCSC_W_BELOW_HORIZON (This is not an error condition - the sun is below the horizon at night); bit 10: PGS_CSC_ZenithAzimuth(Sun) returned PGSCSC_W_UNDEFINED_AZIMUTH; bit 11: PGS_CSC_ZenithAzimuth(Sun) returned PGSCSC_W_NO_REFRACTION; bit 12: PGS_CSC_ZenithAzimuth(Sun) returned PGSCSC_E_INVALID_VECTAG; bit 13: PGS_CSC_ZenithAzimuth(Sun) returned PGSCSC_E_LOOK_PT_ALTIT_RANGE; bit 14: PGS_CSC_ZenithAzimuth(Sun) returned PGSCSC_E_ZERO_INPUT_VECTOR; bit 15: PGS_CSC_ZenithAzimuth(Sun) returned PGS_E_TOOLKIT
demgeoqa	16-bit unsigned integer	None	Digital Elevation Model (DEM) Geolocation QA flags: bit 0 (LSB): bad input value; bit 1: Could not allocate memory; bit 2: Too close to North or South pole. Excluded; bit 3: Layer resolution incompatibility. Excluded; bit 4: Any DEM Routine (elev) returned PGSDM_E_IMPROPER_TAG; bit 5: Any DEM Routine (elev) returned PGSDM_E_CANNOT_ACCESS_DATA; bit 6: Any DEM Routine (land/water) returned PGSDM_E_IMPROPER_TAG; bit 7: Any DEM Routine (land/water) returned PGSDM_F_CANNOT_ACCESS_DATA; bit



			8: Reserved for future layers; bit 9: Reserved for future layers; bit 10: PGS_DEM_GetRegion(elev) returned PGSDEM_M_FILLVALUE_INCLUDED; bit 11: PGS_DEM_GetRegion(land/water) returned PGSDEM_M_FILLVALUE_INCLUDED; bit 12: Reserved for future layers; bit 13: PGS_DEM_GetRegion(all) returned PGSDEM_M_MULTIPLE_RESOLUTIONS; bit 14: PGS_CSC_GetFOV_Pixel() returned any 'W' class return code except PGS_CSC_W_PREDICTED_UT1; bit 15: PGS_CSC_GetFOV_Pixel() returned any 'E' class return code
satzen	32-bit floating-point	None	Spacecraft zenith angle (0.0 ... 180.0) degrees from zenith (measured relative to the geodetic vertical on the reference (WGS84) spheroid and including corrections outlined in EOS SDP toolkit for normal accuracy.)
satazi	32-bit floating-point	None	Spacecraft azimuth angle (-180.0 ... 180.0) degrees E of N GEO)
solzen	32-bit floating-point	None	Solar zenith angle (0.0 ... 180.0) degrees from zenith (measured relative to the geodetic vertical on the reference (WGS84) spheroid and including corrections outlined in EOS SDP toolkit for normal accuracy.)
solazi	32-bit floating-point	None	Solar azimuth angle (-180.0 ... 180.0) degrees E of N GEO)
sun_glint_distance	16-bit integer	None	Distance (km) from footprint center to location of the sun glint (-9999 for unknown, 30000 for no glint visible because spacecraft is in Earth's shadow)
topog	32-bit floating-point	None	Mean topography in meters above reference ellipsoid
topog_err	32-bit floating-point	None	Error estimate for topog
landFrac	32-bit floating-point	None	Fraction of spot that is land (0.0 ... 1.0)
landFrac_err	32-bit floating-point	None	Error estimate for landFrac
satzen_amsu	32-bit floating-point	None	Satellite zenith angle (0.0 ... 180.0) degrees from zenith (measured relative to the geodetic vertical on the reference (WGS84) spheroid and including corrections outlined in EOS SDP toolkit for normal accuracy.) (AMSU-A FOV center)
satazi_amsu	32-bit floating-point	None	Spacecraft azimuth angle (-180.0 ... 180.0) degrees E of N GEO (AMSU-A FOV center)
satzen_hsb	32-bit floating-point	None	Satellite zenith angle (0.0 ... 180.0) degrees from zenith (measured relative to the geodetic vertical on the reference (WGS84) spheroid and including corrections outlined in EOS SDP toolkit for normal accuracy.) (HSB center FOV)
satazi_hsb	32-bit floating-point	None	Spacecraft azimuth angle (-180.0 ... 180.0) degrees E of N GEO (HSB center FOV)
latAIRS	32-bit floating-point	AIRSTrack (= 3) * AIRSXTrack (= 3)	Geodetic center latitude of AIRS spots in degrees North (-90.0 ... 90.0)
lonAIRS	32-bit floating-point	AIRSTrack (= 3) * AIRSXTrack (= 3)	Geodetic center longitude of AIRS spots in degrees East (-180.0 ... 180.0)
PrecipAA4_50km	8-bit unsigned integer	None	Relative interference (0-2) of precipitation on AMSU-A channel 4 (-1/255 for unknown)
PrecipAA5_50km	8-bit unsigned integer	None	Relative interference (0-2) of precipitation on AMSU-A channel 5 (-1/255 for unknown)
PrecipAA6_50km	8-bit unsigned integer	None	Relative interference (0-2) of precipitation on AMSU-A channel 6 (-1/255 for unknown)
PrecipAA7_50km	8-bit unsigned integer	None	Relative interference (0-2, 3=indeterminate) of precipitation on AMSU-A channel 7 (-1/255 for unknown)
PrecipAA8_50km	8-bit unsigned integer	None	Relative interference (0-2) of precipitation on AMSU-A channel 8 (-1/255 for unknown)
PrecipAA9_50km	8-bit unsigned integer	None	Relative interference (0-2) of precipitation on AMSU-A channel 9 (-1/255 for unknown)
PrecipAA4_15km	8-bit unsigned integer	AIRSTrack (= 3) * AIRSXTrack (= 3)	Relative interference (0-2) of precipitation on AMSU-A channel 4 for HSB 15-km spots (-1/255 for unknown)
PrecipAA5_15km	8-bit unsigned integer	AIRSTrack (= 3) * AIRSXTrack (= 3)	Relative interference (0-2) of precipitation on AMSU-A channel 5 for HSB 15-km spots (-1/255 for unknown)

PrecipAA6_15km	8-bit unsigned integer	AIRSTrack (= 3) * AIRSXTrack (= 3)	Relative interference (0-2) of precipitation on AMSU-A channel 6 for HSB 15-km spots (-1/255 for unknown)
PrecipAA7_15km	8-bit unsigned integer	AIRSTrack (= 3) * AIRSXTrack (= 3)	Relative interference (0-2, 3=indeterminate) of precipitation on AMSU-A channel 7 for HSB 15-km spots (-1/255 for unknown)
PrecipAA8_15km	8-bit unsigned integer	AIRSTrack (= 3) * AIRSXTrack (= 3)	Relative interference (0-2) of precipitation on AMSU-A channel 8 for HSB 15-km spots (-1/255 for unknown)
PrecipAA9_15km	8-bit unsigned integer	AIRSTrack (= 3) * AIRSXTrack (= 3)	Relative interference (0-2) of precipitation on AMSU-A channel 9 for HSB 15-km spots (-1/255 for unknown)
AMSU_A_4_Precip_Corr_50km	32-bit floating-point	None	Correction to AMSU-A channel 4 for precipitation effects (Kelvins)
AMSU_A_5_Precip_Corr_50km	32-bit floating-point	None	Correction to AMSU-A channel 5 for precipitation effects (Kelvins)
AMSU_A_6_Precip_Corr_50km	32-bit floating-point	None	Correction to AMSU-A channel 6 for precipitation effects (Kelvins)
AMSU_A_7_Precip_Corr_50km	32-bit floating-point	None	Correction to AMSU-A channel 7 for precipitation effects (Kelvins)
AMSU_A_8_Precip_Corr_50km	32-bit floating-point	None	Correction to AMSU-A channel 8 for precipitation effects (Kelvins)
AMSU_A_9_Precip_Corr_50km	32-bit floating-point	None	Correction to AMSU-A channel 9 for precipitation effects (Kelvins)
AMSU_A_4_Precip_Corr_15km	32-bit floating-point	AIRSTrack (= 3) * AIRSXTrack (= 3)	Correction to AMSU-A channel 4 for precipitation effects for HSB 15-km spots (Kelvins)
AMSU_A_5_Precip_Corr_15km	32-bit floating-point	AIRSTrack (= 3) * AIRSXTrack (= 3)	Correction to AMSU-A channel 5 for precipitation effects for HSB 15-km spots (Kelvins)
AMSU_A_6_Precip_Corr_15km	32-bit floating-point	AIRSTrack (= 3) * AIRSXTrack (= 3)	Correction to AMSU-A channel 6 for precipitation effects for HSB 15-km spots (Kelvins)
AMSU_A_7_Precip_Corr_15km	32-bit floating-point	AIRSTrack (= 3) * AIRSXTrack (= 3)	Correction to AMSU-A channel 7 for precipitation effects for HSB 15-km spots (Kelvins)
AMSU_A_8_Precip_Corr_15km	32-bit floating-point	AIRSTrack (= 3) * AIRSXTrack (= 3)	Correction to AMSU-A channel 8 for precipitation effects for HSB 15-km spots (Kelvins)
AMSU_A_9_Precip_Corr_15km	32-bit floating-point	AIRSTrack (= 3) * AIRSXTrack (= 3)	Correction to AMSU-A channel 9 for precipitation effects for HSB 15-km spots (Kelvins)
rain_rate_50km	32-bit floating-point	None	Rain rate (mm/hr)
rain_rate_15km	32-bit floating-point	AIRSTrack (= 3) * AIRSXTrack (= 3)	Rain rate for HSB 15-km spots (mm/hr)
MWSurfClass	8-bit integer	None	Surface class from MW: 0 for coastline; 1 for land; 2 for ocean; 3 for first-year sea-ice; 4 for multi-year sea-ice; 5 for snow; 6 for glacier; -1/255 for unknown; more TBD
PSurfStd	32-bit floating-point	None	Surface pressure first guess in mb, interpolated from forecast
nSurfSup	32-bit integer	None	Index of first pressure level above mean surface (90 ... 100)
TSurfStd	32-bit floating-point	None	Surface skin temperature in Kelvins
TSurfAir	32-bit floating-point	None	Surface air temperature in Kelvins
TAirSup	32-bit floating-point	XtraPressureLev (= 100)	Atmospheric Temperature at XtraPressLev in Kelvins
H2OCDSup	32-bit floating-point	XtraPressureLay (= 100)	Layer column water vapor (molecules / cm**2)
lwCDSup	32-bit floating-point	XtraPressureLay (= 100)	Layer molecular column density (molecules / cm**2) of cloud liquid water
lwCDSupErr	32-bit floating-point	XtraPressureLay (= 100)	Error estimate for lwCDSup
clWSup	32-bit integer	XtraPressureLay (= 100)	Cloud Ice/Water flag (liquid = 0 / Ice = 1)
O3CDSup	32-bit floating-point	XtraPressureLay (= 100)	Layer column ozone in molecules per cm**2
O3CDInit	32-bit floating-point	XtraPressureLay (= 100)	preliminary Layer column ozone in molecules per cm**2 from initial regression step
COCDSup	32-bit	XtraPressureLay (= 100)	Layer column carbon monoxide in molecules per cm**2

	floating-point	100)	
CO2ppmv	32-bit floating-point	None	Column averaged dry carbon dioxide volumetric mixing ratio (ppmv)
CH4CDSup	32-bit floating-point	XtraPressureLay (= 100)	Layer column methane (in molecules per cm**2)
COCDSupErr	32-bit floating-point	XtraPressureLay (= 100)	Error estimate for COCDSup
CO2ppmvErr	32-bit floating-point	None	Error estimate for co2qppmv
CH4CDSupErr	32-bit floating-point	XtraPressureLay (= 100)	Error estimate for CH4CDSup
numHingeCloud	16-bit integer	None	Number of hinge points for cloud emissivity and reflectivity
emisIRInit	32-bit floating-point	HingeSurfInit (= 50)	IR Surface Emissivities from initial regression (in order of increasing frequency. Only first numHingeSurfInit elements are valid)
rhoIRInit	32-bit floating-point	HingeSurfInit (= 50)	IR Surface Reflectivities from initial regression (in order of increasing frequency. Only first numHingeSurfInit elements are valid)
olr	32-bit floating-point	None	Outgoing Longwave Radiation Flux integrated over 2 to 2800 cm**-1 (Watts/m**2)
clrolr	32-bit floating-point	None	Clear-sky Outgoing Longwave Radiation Flux integrated over 2 to 2800 cm**-1 (Watts/m**2)
cldFreq	32-bit floating-point	Cloud (= 2) * HingeCloud (= 7)	Frequencies for cloud emissivity and reflectivity (in order of increasing pressure. Only first numCloud elements are valid) (in order of increasing frequency. Only first numHingeCloud elements are valid)
CldEmis	32-bit floating-point	Cloud (= 2) * HingeCloud (= 7)	Ratio of cloud IR emissivity to that at 930 cm-1 (in order of increasing frequency. Only first numHingeCloud elements are valid)
CldRho	32-bit floating-point	Cloud (= 2) * HingeCloud (= 7)	Future Cloud IR reflectivity -- DO NOT USE
CldEmisErr	32-bit floating-point	Cloud (= 2) * HingeCloud (= 7)	Error estimate for CldEmis
CldRhoErr	32-bit floating-point	Cloud (= 2) * HingeCloud (= 7)	Error estimate for CldRho
CldMapVis	8-bit integer	AIRSTrack (= 3) * AIRSXTTrack (= 3) * VisTrack (= 9) * VisXTrack (= 8)	Map of clear/cloud pixel locations. (-1 = not known; 0 = clear; 1 = cloudy)
CldFrcVis	8-bit integer	AIRSTrack (= 3) * AIRSXTTrack (= 3)	Integer percentage of Visible pixels in AIRS field-of-view identified as cloudy (-1/255 for unknown)
CldFrcVisErr	8-bit integer	AIRSTrack (= 3) * AIRSXTTrack (= 3)	Error Estimate for CldFrcVis (percentage points)
ClrFrcVis	8-bit integer	AIRSTrack (= 3) * AIRSXTTrack (= 3)	Integer percentage of Visible pixels in AIRS field-of-view identified as clear. (-1/255 for unknown) NOTE: because some pixels cannot be identified as either clear or cloudy CldFrcVis + ClrFrcVis may be less than 100.
ClrFrcVisErr	8-bit integer	AIRSTrack (= 3) * AIRSXTTrack (= 3)	Error Estimate for ClrFrcVis (percentage points)
VarIndxAllVis	8-bit integer	AIRSTrack (= 3) * AIRSXTTrack (= 3)	Variability index of all visible pixels in AIRS field-of-view (-1/255 for unknown)
VarIndxClrVis	8-bit integer	AIRSTrack (= 3) * AIRSXTTrack (= 3)	Variability index of those visible pixels in AIRS field-of-view identified as clear (-1/255 for unknown)
rhoVis	8-bit integer	AIRSTrack (= 3) * AIRSXTTrack (= 3) * VisTrack (= 9) * VisXTrack (= 8) * VChn (= 4)	Visible reflectivity integer percent (0 ... 100) (-1/255 for unknown)
cornerlats	32-bit floating-point	AIRSTrack (= 3) * AIRSXTTrack (= 3) * VisGeoSpots (= 4) * VChn (= 4)	Geodetic Latitudes at the centers of the pixels at the corners of the IR footprint by channel in degrees North (-90.0 ... 90.0)
cornerlons	32-bit floating-point	AIRSTrack (= 3) * AIRSXTTrack (= 3) * VisGeoSpots (= 4) * VChn (= 4)	Geodetic Longitudes at the centers of the pixels at the corners of the IR footprint by channel in degrees East (-180.0 ... 180.0)
fov_clear_flag	8-bit integer	AIRSTrack (= 3) * AIRSXTTrack (= 3)	Preliminary clear flag based on MW/IR differences
fov_rad_resid	32-bit floating-point	AIRSTrack (= 3) * AIRSXTTrack (= 3)	Preliminary residual between IR radiance and IR radiance predicted from MW
fov_psw_fr_lw_resid	32-bit	AIRSTrack (= 3) *	Residual between shortwave radiance & shortwave radiance predicted

	floating-point	AIRSTTrack (= 3)	from longwave
fov_psst_resid	32-bit floating-point	AIRSTTrack (= 3) * AIRSTXTrack (= 3)	Residual between Surface Temperatures and those predicted from window channel observations
fov_swlw_resid	32-bit floating-point	AIRSTTrack (= 3) * AIRSTXTrack (= 3)	residual between shortwave and longwave observations
fov_ocean_cc_test	32-bit floating-point	CCTest (= 10) * AIRSTTrack (= 3) * AIRSTXTrack (= 3)	clear tests for Ocean, test 1 to 10: 1: Brightness temperature of 965.323 cm <sup>-1</sup> ; 2: Sea Surface Temperature (SST) - brightness temperature of 965.323 cm <sup>-1</sup> ; 3: Brightness temperature of 2616.095 cm <sup>-1</sup> - predicted from 8 micron window observations; 4: Brightness temperature of 2616.095 cm <sup>-1</sup> - predicted from 11 micron window observations; 5: SST - predicted SST from window channels; 6: Store the value of SST; 7 - 10: TBD
prelim_clear_flag	8-bit integer	None	Preliminary clear flag based on IR spacial inhomogeneity
prelim_rad_dev	32-bit floating-point	None	Preliminary deviations between fov_rad_resids within a 3x3 FOV retrieval array
tsurf_forecast	32-bit floating-point	None	Predicted surface temperature from forecast (K)
tsurf_diff_4um	32-bit floating-point	AIRSTTrack (= 3) * AIRSTXTrack (= 3)	Difference between SST predicted from AIRS 4 microns (2616 & 2707 cm <sup>-1</sup> ) observations and SST from a forecast model (K)
tsurf_diff_11um	32-bit floating-point	AIRSTTrack (= 3) * AIRSTXTrack (= 3)	Difference between SST predicted from AIRS 11 microns split window observations and SST from a forecast model, (K)
spatial_coh_4um	32-bit floating-point	AIRSTTrack (= 3) * AIRSTXTrack (= 3)	This is the standard deviation of brightness temperature at 2616 cm <sup>-1</sup> over 3X3 AIRS footprints as a measure of spatial homogeneity.
spatial_coh_11um	32-bit floating-point	AIRSTTrack (= 3) * AIRSTXTrack (= 3)	This is the standard deviation of Difference between SST predicted from AIRS 11 microns split window observations and SST from a forecast model, (K)
cldHgtMapVis	8-bit integer	AIRSTTrack (= 3) * AIRSTXTrack (= 3) * VisTrack (= 9) * VisXTrack (= 8)	Map of low-cloud pixel locations. (-1=unknown, 0=not low-cloud, 1=low-cloud.)
cldHgtCntVis	8-bit integer	AIRSTTrack (= 3) * AIRSTXTrack (= 3)	Count of number of distinct cloud heights in visible data found in an AIRS field-of-view (-1/255 for unknown)
cldHgtCntVisErr	8-bit integer	AIRSTTrack (= 3) * AIRSTXTrack (= 3)	Error estimate for cldHgtCntVis
TAirMWOnly	32-bit floating-point	XtraPressureLev (= 100)	Air temperature in Kelvins from microwave-only retrieval
H2OCDMWOnly	32-bit floating-point	XtraPressureLay (= 100)	Layer column water vapor from microwave-only retrieval (molecules / cm**2)
TAirMWOnlyErr	32-bit floating-point	StdPressureLev (= 28)	Error estimate for TAIRMWOnly (Note that error estimate only made at StdPressureLev points even though TAIRMWOnly is estimated at XtraPressureLev points)
H2OCDMWOnlyErr	32-bit floating-point	StdPressureLay (= 28)	Error estimate for H2OCDMWOnly (Note that error estimate only made at StdPressureLay points even though H2OCDMWOnly is estimated at XtraPressureLay points)
TSurf1Ret	32-bit floating-point	None	Surface temperature after first retrieval in Kelvins
TSurfAir1Ret	32-bit floating-point	None	Surface air temperature after first retrieval in Kelvins
TAir1Ret	32-bit floating-point	XtraPressureLev (= 100)	Air temperature after first retrieval in Kelvins
H2OCD1Ret	32-bit floating-point	XtraPressureLay (= 100)	Layer column water vapor after first retrieval (molecules / cm**2)
invalid	8-bit integer	None	No valid output (1: True, 0: False, 255/-1: Unknown)
clear_flag	8-bit integer	None	1 for 100% clear, 0 for
MW_ret_used	8-bit integer	None	MW-only final retrieval used (1: True, 0: False, 255/-1: Unknown)
retrieval_type	8-bit integer	None	Deprecated -- use RetQAFlag. Retrieval type: 0 for full retrieval; 10 for MW + final succeeded, initial retrieval failed; 20 for MW + initial succeeded, final failed; 30 for only MW stage succeeded, initial + final retrieval failed; 40 for MW + initial succeeded, final cloud-clearing failed; 50 for only MW stage succeeded, initial + final cloud-clearing failed; 100 for no retrieval;
bad_l1b	8-bit integer	None	Level 2 process not allowed due to bad level 1b data (1: True, 0: False, 255/-1: Unknown)
bad_l1b_amsu	8-bit integer	None	Bad AMSU-A level 1b data (1: True, 0: False, 255/-1: Unknown)
bad_l1b_hsb	8-bit integer	None	Bad HSB level 1b data (1: True, 0: False, 255/-1: Unknown)
bad_l1b_airs	8-bit integer	None	Bad AIRS level 1b data (1: True, 0: False, 255/-1: Unknown)

bad_l1b_vis	8-bit integer	None	Bad VIS level 1b data (1: True, 0: False, 255/-1: Unknown)
forecast	8-bit integer	None	Complete forecast guess was used (1: True, 0: False, 255/-1: Unknown)
no_psurf_guess	8-bit integer	None	No surface pressure was available. Topography was used for surf press (1: True, 0: False, 255/-1: Unknown)
bad_temps	8-bit integer	None	invalid temp and surface skin temp (1: True, 0: False, 255/-1: Unknown)
bad_h2o	8-bit integer	None	invalid water vapor profile (1: True, 0: False, 255/-1: Unknown)
bad_o3	8-bit integer	None	invalid ozone profile (1: True, 0: False, 255/-1: Unknown)
bad_clouds	8-bit integer	None	invalid cloud parameters (1: True, 0: False, 255/-1: Unknown)
bad_low_atm	8-bit integer	None	invalid result below 100 mb (1: True, 0: False, 255/-1: Unknown)
no_tuning	8-bit integer	None	Standard br temp tuning NOT applied (1: True, 0: False, 255/-1: Unknown)
no_ang_corr	8-bit integer	None	Standard angle correction NOT applied (1: True, 0: False, 255/-1: Unknown)
no_mw	8-bit integer	None	MW only retrieval not attempted (1: True, 0: False, 255/-1: Unknown)
no_initial	8-bit integer	None	First retrieval not attempted (1: True, 0: False, 255/-1: Unknown)
no_final	8-bit integer	None	Final retrieval not attempted (1: True, 0: False, 255/-1: Unknown)
mw_fpe	8-bit integer	None	floating-point exception in MW retrieval step (1: True, 0: False, 255/-1: Unknown)
initial_fpe	8-bit integer	None	floating-point exception in Initial retrieval step (1: True, 0: False, 255/-1: Unknown)
final_fpe	8-bit integer	None	floating-point exception in Final retrieval step (1: True, 0: False, 255/-1: Unknown)
MWPrecip	8-bit integer	None	Precipitation was detected over 0.5 mm/hr (1: True, 0: False, 255/-1: Unknown)
MWsurf_R0	32-bit floating-point	None	internal adjustment parameter -- surface R0
MWsurf_T0	32-bit floating-point	None	internal adjustment parameter -- surface T0
MWsurf_Tinf	32-bit floating-point	None	internal adjustment parameter -- surface Tinfinity
MWseaice_conc	32-bit floating-point	None	ice or snow concentration (0-1)
MWresidual_temp	32-bit floating-point	None	sum of squares of temperature residuals normalized by channel sensitivities
MWresidual_mois	32-bit floating-point	None	sum of squares of moisture residuals normalized by channel sensitivities
MWresidual_AMSUA	32-bit floating-point	ChanAMSUA (= 15)	Brightness temperature residual for each AMSU-A channel (Kelvin)
MWresidual_HSB	32-bit floating-point	ChanHSB (= 5)	brightness temperature residual for each HSB channel (Kelvin)
MWiter_temp	8-bit integer	None	# of iterations of the temperature profile (-1/255 for Unknown)
MWiter_mois	8-bit integer	None	# of iterations of the moisture profile (-1/255 for Unknown)
mw_ret_code	8-bit integer	None	Return code status of MW retrieval: 0: Useable MW retrieval; >0: Unuseable MW retrieval; 1: Reject due to high residuals in one or more valid channels; 2 Not enough valid channels to retrieve; 3 Non-positive definite moisture/surface retrieval; 4 Non-positive definite temperature retrieval; -1/255 Unknown
cloud_ice	8-bit integer	None	Scattering by cloud ice present in FOV (1: True, 0: False, 255/-1: Unknown)
icc_too_cloudy	8-bit integer	None	Initial cloud clearing pass too cloudy (1: True, 0: False, 255/-1: Unknown)
icc_low_contrast	8-bit integer	None	Initial cloud clearing pass contrast too low (1: True, 0: False, 255/-1: Unknown)
icc_bad_rad	8-bit integer	None	Initial cloud clearing pass cloud cleared radiances do not match clear guess - reject the IR retrieval (1: True, 0: False, 255/-1: Unknown)
icc_percent_cld	8-bit integer	None	Initial cloud clearing cloudy percent (-1/255 for Unknown)
icc_contrast	32-bit floating-point	None	Initial cloud clearing contrast (units?)
bad_1st	8-bit integer	None	The initial retrieval failed (1: True, 0: False, 255/-1: Unknown)
bad_1st_cc	8-bit integer	None	The first cloud clearing failed (1: True, 0: False, 255/-1: Unknown)
bad_1st_regres	8-bit integer	None	The regression guess failed (1: True, 0: False, 255/-1: Unknown)

bad_1st_phys	8-bit integer	None	The first physical retrieval failed (1: True, 0: False, 255/-1: Unknown)
fcc_too_cloudy	8-bit integer	None	Final cloud clearing pass too cloudy (1: True, 0: False, 255/-1: Unknown)
fcc_low_contrast	8-bit integer	None	Final cloud clearing pass contrast too low (1: True, 0: False, 255/-1: Unknown)
fcc_bad_rad	8-bit integer	None	Final cloud clearing pass cloud cleared radiances do not match clear guess - reject the IR retrieval (1: True, 0: False, 255/-1: Unknown)
fcc_percent_cld1	8-bit integer	None	Final cloud clearing cloudy percent pass 1 (-1/255 for Unknown)
fcc_percent_cld2	8-bit integer	None	Final cloud clearing cloudy percent pass 2 (-1/255 for Unknown)
fcc_contrast1	32-bit floating-point	None	Final cloud clearing contrast (units?) pass 1
fcc_contrast2	32-bit floating-point	None	Final cloud clearing contrast (units?) pass 2
bad_final	8-bit integer	None	Final retrieval failed (1: True, 0: False, 255/-1: Unknown)
bad_final_cc	8-bit integer	None	final cloud clearing failed (1: True, 0: False, 255/-1: Unknown)
bad_final_ir	8-bit integer	None	final IR retrieval failed (1: True, 0: False, 255/-1: Unknown)
bad_final_surf	8-bit integer	None	final surface ret failed (1: True, 0: False, 255/-1: Unknown)
bad_final_temp	8-bit integer	None	final temp ret failed (1: True, 0: False, 255/-1: Unknown)
bad_final_h2o	8-bit integer	None	final water vapor ret failed (1: True, 0: False, 255/-1: Unknown)
bad_final_o3	8-bit integer	None	final ozone ret failed (1: True, 0: False, 255/-1: Unknown)
bad_final_cloud	8-bit integer	None	final cloud ret failed (1: True, 0: False, 255/-1: Unknown)
bad_cc_cld_ret	8-bit integer	None	Cloud clearing and cloud ret are inconsistent (1: True, 0: False, 255/-1: Unknown)
MW_IR_ret_differ	8-bit integer	None	Microwave and IR temperature retrieval differ too much - reject final IR retrieval (1: True, 0: False, 255/-1: Unknown)
bad_MW_low_resid	8-bit integer	None	Microwave residuals in lower atmosphere too large - reject final IR retrieval (1: True, 0: False, 255/-1: Unknown)
MW_low_atm_resid	32-bit floating-point	None	MW residual for lower atmosphere after final retrieval
final_AMSU_ret	8-bit integer	None	0 for success; 1 for did not converge; 2 for residual too large
final_HSB_ret	8-bit integer	None	0 for success; 1 for did not converge; 2 for residual too large
final_cloud_ret	8-bit integer	None	0 for success; 1 for did not converge; 2 for residual too large
final_surf_ret	8-bit integer	None	0 for success; 1 for did not converge; 2 for residual too large
final_temp_ret	8-bit integer	None	0 for success; 1 for did not converge; 2 for residual too large
final_h2o_ret	8-bit integer	None	0 for success; 1 for did not converge; 2 for residual too large
final_o3_ret	8-bit integer	None	0 for success; 1 for did not converge; 2 for residual too large
final_ch4_ret	8-bit integer	None	0 for success; 1 for did not converge; 2 for residual too large
final_co_ret	8-bit integer	None	0 for success; 1 for did not converge; 2 for residual too large
final_co2_ret	8-bit integer	None	0 for success; 1 for did not converge; 2 for residual too large
low_sun	8-bit integer	None	solar zenith angle > 60 degrees (1: True, 0: False, 255/-1: Unknown)
wide_ang	8-bit integer	None	viewing angle at center of AIRS spot > 50 degrees (1: True, 0: False, 255/-1: Unknown)
vis_glint	8-bit integer	None	sun-glint is expected to alter radiances for any water surfaces in the AMSU FOV by at least 5%. (No test is made, however, for whether any water is actually located within the FOV.) (1: True, 0: False, 255/-1: Unknown)
bad_vis_rad	8-bit integer	None	Vis/NIR radiance out of range (1: True, 0: False, 255/-1: Unknown)
bad_vis_cal	8-bit integer	None	Vis/NIR calibration data old or invalid (1: True, 0: False, 255/-1: Unknown)
bad_vis_det_temp	8-bit integer	None	Vis/NIR Detector temperature out of range (1: True, 0: False, 255/-1: Unknown)
bad_scan_hd_temp	8-bit integer	None	Scan Head Assembly temperature out of range (1: True, 0: False, 255/-1: Unknown)
bad_vis_cld_det	8-bit integer	None	Cloud detection failed (1: True, 0: False, 255/-1: Unknown)
bad_vis_cld_hgt	8-bit integer	None	Cloud height failed (1: True, 0: False, 255/-1: Unknown)
bad_ref_NDVI	8-bit integer	None	Bad reference Normalized Differential Vegetation Index (1: True, 0: False, 255/-1: Unknown)
bad_vis_var	8-bit integer	None	Variability index invalid (1: True, 0: False, 255/-1: Unknown)

vis_clear	8-bit integer	None	at least 97.2% of each IR FOV within the AMSU FOV is clear sky (1: True, 0: False, 255/-1: Unknown)
vis_cloudy	8-bit integer	None	at least 79.2% of each IR FOV within the AMSU FOV is cloudy (1: True, 0: False, 255/-1: Unknown)
vis_low_cloud	8-bit integer	None	at least 79.2% of each IR FOV within the AMSU FOV is low_cloud (1: True, 0: False, 255/-1: Unknown)
Initial_CC_score	32-bit floating-point	None	Indicator of how well the initial cloud-cleared radiances match radiances reconstructed from clear eigenvectors. (0.0 for a perfect match; 10.0 indicates a major problem)
Initial_CC_subscores	32-bit floating-point	ScoresBand (= 10)	Sub-scores contributing to Initial_CC_score, by frequency band

Size: 18141300 bytes (18.1 MB) per 45-scanset granule

**Total File Size (plus storage for dimensions and other HDF-EOS overhead):  
18180287 bytes (18.2 MB) per 45-scanset granule = 4363.3 MB per day**

## Special AIRS Types

Limited Engineering Struct: This type is used for engineering data fields for which there are known "yellow" limits

Field Name	Type	Explanation
min	32-bit floating-point	Minimum value field takes on in granule (not valid when num_in = 0)
max	32-bit floating-point	Maximum value field takes on in granule (not valid when num_in = 0)
mean	32-bit floating-point	Mean of in-range values field takes on in granule (not valid when num_in = 0)
dev	32-bit floating-point	Standard Deviation of in-range values field takes on in granule (not valid when num_in = 0)
num_in	32-bit integer	Count of in-range values field takes on in granule
num_lo	32-bit integer	Count of out-of-range low values field takes on in granule
num_hi	32-bit integer	Count of out-of-range high values field takes on in granule
num_bad	32-bit integer	Count of occasions on which field takes on invalid flag value (-9999) in granule
range_min	32-bit floating-point	Minimum in-range value. Any value less than this is counted in num_lo and is not used in the calculation of mean & dev.
range_max	32-bit floating-point	Maximum in-range value. Any value greater than this is counted in num_hi and is not used in the calculation of mean & dev.
missing	8-bit integer	Missing limits flags. Bit 0 (LSB) is 1 when yellow low (range_min) limit is missing; Bit 1 is high when yellow high (range_max) limit is missing; other bits unused, set to 0.
max_track	32-bit integer	GeoTrack index (counting from 1) where max was found
max_xtrack	32-bit integer	GeoXTrack index (counting from 1) where max was found
min_track	32-bit integer	GeoTrack index (counting from 1) where min was found
min_xtrack	32-bit integer	GeoXTrack index (counting from 1) where min was found

Unlimited Engineering Struct: This type is used for engineering data fields for which there are NOT known "yellow" limits

Field Name	Type	Explanation
min	32-bit floating-point	Minimum value field takes on in granule (not valid when num = 0)
max	32-bit floating-point	Maximum value field takes on in granule (not valid when num = 0)
mean	32-bit floating-point	Mean of values field takes on in granule (not valid when num = 0)
dev	32-bit floating-point	Standard Deviation of values field takes on in granule (not valid when num = 0)
num	32-bit integer	Count of occurrences of field in granule (not including those counted in num_bad)
num_bad	32-bit integer	Count of occasions on which field takes on invalid flag value (-9999) in granule
max_track	32-bit integer	GeoTrack index (counting from 1) where max was found
max_xtrack	32-bit integer	GeoXTrack index (counting from 1) where max was found
min_track	32-bit integer	GeoTrack index (counting from 1) where min was found
min_xtrack	32-bit integer	GeoXTrack index (counting from 1) where min was found

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## Appendix B. AIRS Level-1B Filename and Local Granule ID (LGID) Convention

AIRS filenames correspond to the "identifier" portion of the ECS Local Granule ID (LGID) standard:

LGID:shortname:version:identifier

where:

":" is a colon that acts as a separator of the parts of the LGID

"LGID" is a literal string

"shortname" is the ECS ESDT shortname

"version" is the ECS ESDT version

"identifier" is

AIRS.yyyy.mm.dd.ggg.Lev.Instr\_Prod.vm.m.r.b.lvid.Fttttttttt.ext  
as detailed below

We'll use identifiers of:

AIRS.yyyy.mm.dd.ggg.Lev.Instr\_Prod.vm.m.r.b.lvid.Fttttttttt.ext

Making the whole LGID:

LGID:shortname:version:AIRS.yyyy.mm.dd.ggg.Lev.Instr\_Prod.vm.m.r.b.lvid.Fttttttttt.ext

where:

AIRS is the literal string "AIRS" to identify this as  
an AIRS-instrument-suite product.

yyyy.mm.dd is the year/month/day of the start of the granule.

Note: yyyy.mm.dd is the date of which T00Z is the start  
for T00Z.L\*.Match\_RaObs, T00Z.Loc\_RaObs, and T00Z.GStat\_RaObs  
files.

Note: yyyy.mm.dd is start of last day specified  
for VegMapxxX

ggg is the granule number in day (001 - 240).

Lev is processing level:

"L1A", "L1B", "L2", or "L3"

Instr is instrument name:

"AMSU" for AMSU-A

"HSB" for HSB

"VIS" for Vis channels of AIRS when there is a separate Vis product

"AIRS" for AIRS/IR \*or\* AIRS/IR + AIRS/Vis

Prod is descriptor of product:

For L1B:

"Rad" for science radiances (including MW instruments,  
where radiances are in units of brightness temperature)

"QaSub" for QA subsets  
For L2:  
"CC" for cloud-cleared AIRS radiances  
"RetStd" for standard retrieval product  
"RetSup" for support retrieval product

vm.m.r.b is the PGEVersion uniquely identifying a configuration of source code + static ancillary files. "v" is the literal character 'v'. It is followed by four numbers separated by three "."s. These are the major & minor version numbers, a release number, and a build number. Example: "v2.5.12.45" is the 45th build of release 12 of version 2.5.

lvid is the LocalVersionID. This field is optional and usually absent.

Note: LocalVersionID is not included when the processing facility is "A" or "G"

F is processing facility ID:  
"G" for GSFC DAAC  
"A" for AIRS TLSCF official TDS processing  
"T" for AIRS TLSCF official testing  
"S" for AIRS TLSCF officially sanctioned simulation  
"D" for any direct broadcast station  
"N" for NOAA NESDIS  
"X" for anything else

ttttttttt is AIRS run tag (000000000000 - 99999999999).

This field is designed to ensure LocalGranuleIDs are unique, even when the same software is used to reprocess the same data. It is local processing time as yyyydoyhhmmss. (year, day-of-year (julian day), hour, minute, second).

Note: this corresponds to PSA AIRSRunTag.

ext is the filetype extension:  
".hdf" for all HDF products (including HDF-EOS)  
".txt" for all text products  
".bin" for raw binary files (not standard products)

Note: when optional fields are absent only one "." appears, never two in a row. Trailing "."s are also omitted.

Here's a full set (one of each type) of granules as currently defined:

Produced by Level-1B PGEs:

AIRS.2001.12.03.131.L1B.AMSU\_Rad.v2.12.5.4.A2002123120634.hdf  
AIRS.2001.12.03.131.L1B.HSB\_Rad.v2.12.5.4.A2002123120634.hdf  
AIRS.2001.12.03.131.L1B.AIRS\_Rad.v2.12.5.4.A2002123120634.hdf  
AIRS.2001.12.03.131.L1B.AIRS\_QaSub.v2.12.5.4.A2002123120634.hdf  
AIRS.2001.12.03.131.L1B.VIS\_Rad.v2.12.5.4.A2002123120634.hdf  
AIRS.2001.12.03.131.L1B.VIS\_QaSub.v2.12.5.4.A2002123120634.hdf

Produced by Level-2 Retrieval PGEs:

AIRS.2001.12.03.131.L2.CC.v2.12.5.4.A2002123120634.hdf

AIRS.2001.12.03.131.L2.RetStd.v2.12.5.4.A2002123120634.hdf

AIRS.2001.12.03.131.L2.RetSup.v2.12.5.4.A2002123120634.hdf

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## Appendix C-1. AIRS Products

ESDT Short Name	Sample File Name (Local Granule ID)	PCF LID	Instr.	Usage	File Size Per Granule (MB)	Files Per Day	Daily Rate (MB per Day)	Description
AIRHASCII	AIRS.2000.12.15.001.L1A.HSB.v2.2.3.33.X02108051026	7122	HSB	L1A Product Output, L1B Product Input	1.0	240	247.2	HSB L1A Science Footprints-HDF: HSB geolocated counts for scene footprints
AIRAASCII	AIRS.2000.12.15.001.L1A.AMSU.v2.2.3.33.X02108050537	7120	AMSU-A	L1A Product Output, L1B Product Input	0.2	240	50.4	AMSU-A L1A Science Footprints-HDF: AMSU-A1 & AMSU-A2 combined, geolocated counts for scene footprints
AIRIASCI	AIRS.2000.12.15.001.L1A.AIRS_Scene.v2.2.3.33.X02108052348	7121	AIRS	L1A Product Output, L1B Product Input	58.7	240	14089.7	AIRS L1A Science Footprints-HDF: AIRS infrared geolocated counts for scene footprints
AIRVASCI	AIRS.2000.12.15.001.L1A.VIS_Scene.v2.2.3.33.X02108052348	7123	AIRS	L1A Product Output, L1B Product Input	9.5	240	2273.9	VIS L1A Science Footprints-HDF: AIRS visible geolocated counts for scene footprints

AIRIACAL	AIRS.2000.12.15.001.L1A.AIRS_Calib.v2.2.3.33.X02108052348	7111	AIRS	L1A Product Output, L1B Product Input	3.9	240	934.2	AIRS L1A Calibration Footprints-HDF: AIRS IR counts for space, blackbody, spectral cal. & photometric cal. sources including engineering data for calibration
AIRVACAL	AIRS.2000.12.15.001.L1A.VIS_Calib.v2.2.3.33.X02108052348	7113	AIRS	L1A Product Output, L1B Product Input	0.5	240	120.5	VIS L1A Calibration Footprints-HDF: AIRS visible counts for space, blackbody, spectral cal. & photometric cal. sources including engineering data for calibration
AIRBAQAP	AIRS.2000.12.15.001.L1A.AIRS_QaSub.v2.2.3.33.X02108052348	7140	AIRS	L1A AIRS/VIS QA Output	0.5	240	114.1	L1A AIRS/VIS QA Product
AIRIAHRE	AIRS.2000.12.15.001.L1A.AIRS_HREng.v2.2.3.33.X02108052348	7130	AIRS	AIRS/VIS High-Rate Engineering Archival Product	1.0	240	239.1	AIRS/VIS High-Rate Engineering Archival Product
AIRIAHRS	AIRS.2000.12.15.001.L1A.AIRS_EngStat.v2.2.3.33.X02108052348	7131	AIRS	AIRS/VIS Engineering Statistics Product	0.2	240	44.0	AIRS/VIS Engineering Statistics Product

AIRHBRAD	AIRS.2000.12.15.001.L1B.HSB_Rad.v2.2.3.33.X02108051208	6302, 6312 & 7212	HSB	L1B Product Output, L2 Product Input, RaObs PGE Input, HSB Daily Browse PGE Input	1.4	240	334.3	HSB L1B Radiances-HDF: HSB geolocated & calibrated brightness temp. in Kelvin
AIRHBQAP	AIRS.2000.12.15.001.L1B.HSB_QaSup.v2.2.3.33.X02108051208	7252	HSB	L1B Optional Product Output	1.9	240	450.8	HSB QA Support Product for debugging
AIRABRAD	AIRS.2000.12.15.001.L1B.AMSU_Rad.v2.2.3.33.X02108050637	6300, 6310 & 7210	AMSU-A	L1B Product Output, L2 Product Input, RaObs PGE Input, AMSU Daily Browse PGE Input	0.3	240	75.2	AMSU-A L1B Radiances-HDF: AMSU-A1 & AMSU-A2 combined, geolocated & calibrated brightness temp. in Kelvin
AIRABQAP	AIRS.2000.12.15.001.L1B.AMSU_QaSup.v2.2.3.33.X02108050637	7250	AMSU-A	L1B Optional Product Output	0.7	240	163.9	AMSU QA Support Product for debugging

AIRIBRAD	AIRS.2000.12.15.001.L1B.AIRS_Rad.v2.2.3.33.X02108054232	6211 & 7211	AIRS	L1B Product Output, L2 Product Input, RaObs PGE Input	121.1	240	29073.7	AIRS L1B Radiances-HDF: AIRS IR Geolocated Radiances in Watts/cm**2/micron/steradian
AIRIBCBS	AIRS.2000.12.15.001.L1B.AIRS_BrSub.v2.2.3.33.X02108054232	7241	AIRS	AIRS L1B Browse Subset, AIRS Daily Browse PGE Input	0.6	240	151.7	AIRS L1B Browse Subset
AIRIBQAP	AIRS.2000.12.15.001.L1B.AIRS_QaSub.v2.2.3.33.X02108054232	7251	AIRS	AIRS L1B QA Product Output	5.5	240	1323.8	AIRS L1B QA Product Output
AIRVBRAD	AIRS.2000.12.15.001.L1B.VIS_Rad.v2.2.3.33.X02108053937	7213	AIRS	L1B Product Output, L2 Product Input, RaObs PGE Input, VIS One-Day Surface PGE Input	16.6	240	3987.9	VIS L1B Radiances-HDF: VIS Geolocated Radiances in Watts/cm**2/micron/steradian
AIRVBQAP	AIRS.2000.12.15.001.L1B.VIS_QaSub.v2.2.3.33.X02108053937	7253	AIRS	VIS L1B QA Product Output	0.9	240	225.1	VIS L1B QA Product Output



AIRX2RET	AIRS.2000.12.15.001.L2.RetStd.v2.2.3.33.X02108055444	7300	AIRS	L2 Product Output, RaObs PGE Input	4.6	240	1114.3	AIRS L2 Standard Retrieval Product
AIRI2CCF	AIRS.2000.12.15.001.L2.CC.v2.2.3.33.X02108055444	7301	AIRS	L2 Product Output, RaObs PGE Input	25.8	240	6190.7	AIRS L2 Cloud-Cleared Radiance Product
AIRX2SUP	AIRS.2000.12.15.001.L2.RetSup.v2.2.3.33.X02108055444	7302	AIRS	L2 Product Output, RaObs PGE Input	17.6	240	4228.5	AIRS L2 Support Product
AIRX2RBS	AIRS.2000.12.15.001.L2.RetBrSub.v2.2.3.33.X02108055444	7310	AIRS	L2 Product Output, L2 Ret Product Daily Browse PGE Input	0.1	240	22.0	AIRS L2 Retrieval Browse Subset Product
AIRI2CBS	AIRS.2000.12.15.001.L2.CCBrSub.v2.2.3.33.X02108055444	7311	AIRS	L2 Product Output, L2 CC Radiance Daily Browse PGE Input	0.1	240	16.9	AIRS L2 Cloud-Cleared Radiance Browse Subset Product
AIRX2QAP	AIRS.2000.12.15.001.L2.RetQa.v2.2.0.89.X02108055444	7303	AIRS	L2 Product Output	2.8	240	683.0	AIRS L2 QA Support Product
AIRXGSTA	L2-RetGStat	8301	AIRS	L2 Product Output	0.25	240	6.0	Granule Statistics versus Truth

AIRX2LOC	AIRS.2000.12.15.T18Z.Loc_RaOb.a.v2.2.0.57.X02108055444	7402	RaObs	RaObs Tempora ry File	Various	4	0.5	Truth Location File
AIRX2MAT	AIRS.2000.12.15.T18Z.L2.Match_RaOb.a.v2.2.0.57.X02108055444	7401		RaObs PGE Output	1000	4	4000	Matchups of radiances, retrievals, and radiosondes - runs 4 times per day in overlapping runs
AIRHBDBR	AIRS.2000.12.15.A.L1B.Browse_HSB.v2.2.3.33.X02108051352	7263	HSB	HSB Daily Browse PGE Output	0.3	2	0.6	HSB Daily Browse Package - Ascending & Descending
AIRABDBR	AIRS.2000.12.15.A.L1B.Browse_AMSU.v2.2.3.33.X02108050955	7261	AMSU-A	AMSU-A Daily Browse PGE Output	0.6	2	1.2	AMSU-A Daily Browse Package - Ascending & Descending
AIRIBDBR	AIRS.2000.12.15.A.L1B.Browse_AIRS.v2.2.3.33.X02108054749	7262	AIRS	AIRS Daily Browse PGE Output	0.4	2	0.8	AIRS Daily Browse Package - Ascending & Descending
AIRX2DBR	AIRS.2000.12.15.A.L2.Browse_Ret.v2.2.3.33.X02108061810	7320	AIRS	L2 Retrieve d Product Daily Browse PGE Output	0.5	2	1.0	L2 Retrieval Daily Browse Package - Ascending & Descending

AIRX2ASD	AIRS.2000.12.15.A.L2.DailyRetSum.v2.2.3.33.X02108061810	7322	AIRS	L2 Retrieve d Product Daily Browse PGE Output	11.5	2	23.0	L2 Browse Summary Data - Ascending & Descending
AIRI2DBR	AIRS.2000.12.15.A.L2.Browse_CC.v2.2.3.33.X02108061724	7321	AIRS	L2 Cloud-Cleared Radiance Daily Browse PGE Output	0.4	2	0.8	L2 Cloud-Cleared Radiance Daily Browse Package - Ascending & Descending
AIRVBVID	Daily Vegetation Map	7500	AIRS	Vis One-Day Surface PGE Output	700	1	700	Daily Vegetation Map; Processing proceeds when all input granules are available, or at least one input granule is available and 48 hours have passed since the time of latest observation. AIRVBVID is an archive-only product, archived but available to external users. See AIRS Production Rules.
AIRVBVIM	Multi-day Vegetation Map	7501	AIRS	Vis Multi-Day Surface PGE Output	700	1	700	Multi-Day Vegetation Map; Processing proceeds when all input AIRSVBVIDs are available, or at least one input AIRSVBVID is available and 52 hours have passed since the time of latest observation. AIRVBIM is an archive-only product, archived but available to external users. See AIRS Production Rules.

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## Appendix C-2. AIRS Dynamic Inputs

ESDT Short Name	Sample File Name (Local Granule ID)	PCF LID	Instr.	Usage	Daily Rate (MB per Day)	Description
PM1EPHND	PM1EPHND#001040920021200000000001	10501		L1A Dynamic Ancillary Input	6.0	Definitive Spacecraft Ephemeris
PM1ATTNR	PM1ATTNR#001040920021200000000001	10502		L1A Dynamic Ancillary Input	6.0	Restituted Spacecraft Attitude
PMCO_HK	DAAC_INST_CARRYOUT-pm_1-epds-2002118005744-2002118010019-01.dmf	4007 & 4008		L1A Dynamic Ancillary Input	12.0	Aqua housekeeping carryout file, including spacecraft & passive analog data
AIRH0ScE	P1540342AAAAAAAAAAAAAAAAA01264200000000.PDS	342/9342	HSB	L1A Product Input	2.2	APID 342/9342: All Science Data Packets collected by the HSB instrument during one scan period
AIR10XNM	P1540257AAAAAAAAAAAAAAAAA01264200000000.PDS	257/9257	AMSU - A	Special Case: L1A Product Input	[1.8]	Special Case: APID 257/9257 AMSU-A1 Science Data Packets - No Mode; substituted for APIDs 261 & 262 when instrument is in "No Mode"
AIRAACAL	P1540259AAAAAAAAAAAAAAAAA01264200000000.PDS	259/9259	AMSU - A	Special Case: L1A Product Input	[7.7]	Special Case: APID 259/9259 AMSU-A1 Science Data Packets - Staring Mode Packet 1; substituted for APID 261 when instrument is in "Staring Mode"
AIRASCAL	P1540260AAAAAAAAAAAAAAAAA01264200000000.PDS	260/9260	AMSU - A	Special Case: L1A Product Input	[5.4]	Special Case: APID 260/9260 AMSU-A1 Science Data Packets - Staring Mode Packet 2; substituted for APID 262 when instrument is in "Staring Mode"

AIR10SCC	P1540261AAAAAAAAAAAAAAAA01264200000000.PDS	261 / 9261	AMSU - A	L1A Product Input	0.4	AMSU-A1 Science Full-Scan #1 Packets APID 261/9261: AMSU-A1 Science Data Packets collected during one full scan of the instruments operating in Full-Scan Mode
AIR10SCI	P1540262AAAAAAAAAAAAAAAA01264200000000.PDS	262 / 9262	AMSU - A	L1A Product Input	0.4	AMSU-A1 Science Full-Scan #2 Packets APID 262/9262: AMSU-A1 Science Data Packets collected during one full scan of the instruments operating in Full-Scan Mode
AIR20XNM	P1540288AAAAAAAAAAAAAAAA01264200000000.PDS	288 / 9288	AMSU - A	Special Case: L1A Product Input	[1.1]	Special Case: APID 288/9288 AMSU-A2 Science Data Packets - No Mode
AIR20XSM	P1540289AAAAAAAAAAAAAAAA01264200000000.PDS	289 / 9289	AMSU - A	Special Case: L1A Product Input	[0.2]	Special Case: APID 289/9289 AMSU-A2 Science Data Packets - Staring Mode
AIR20SCI	P1540290AAAAAAAAAAAAAAAA01264200000000.PDS	290 / 9290	AMSU - A	L1A Product Input	0.2	APID 290/9290 AMSU-A2 Science Data Packets collected during one full scan of the instruments operating in Full- Scan Mode
AIRB0SCI	P1540404AAAAAAAAAAAAAAAA01264200000000.PDS	404 / 9404	AIRS	L1A Product Input	624.9	AIRS Scene Packets APID 404/9404: Each packet in this collection contains ground footprint data collected by the AIRS instrument for one footprint position. There are 90 of these packets for each scan of the AIRS instrument.

AIRB0CAL	P1540405AAAAAAAAAAAAAAAA01264200000000.PDS	405/ 9405	AIRS	L1A Product Input	6.9	AIRS Spacelook Packets APID 405/9405
AIRB0CAH	P1540406AAAAAAAAAAAAAAAA01264200000000.PDS	406/ 9406	AIRS	L1A Product Input	6.9	AIRS Blackbody Packets APID 406/9406
AIRB0CAP	P1540407AAAAAAAAAAAAAAAA01264200000000.PDS	407/ 9407	AIRS	L1A Product Input	6.9	AIRS Spectral/ Photometric Packets APID 407/9407
AIRH1ENC	P1540414AAAAAAAAAAAAAAAA01264200000000.PDS	414/ 9414	AIRS	L1A Product Input	6.9	AIRS STD HR ENG #1 Packets APID 414/9414
AIRH2ENC	P1540415AAAAAAAAAAAAAAAA01264200000000.PDS	415/ 9415	AIRS	L1A Product Input	6.9	AIRS STD HR ENG #2 Packets APID 415/9415
AIRH1ENG	P1540416AAAAAAAAAAAAAAAA01264200000000.PDS	416/ 9416	AIRS	Special Case: L1A Product Input	[6.9]	Special Case: AIRS Flex HR ENG #2 Packets APID 416/9416; substituted for APID 414 when instrument is commanded to produce flexible engineering data
AIRH2ENG	P1540417AAAAAAAAAAAAAAAA01264200000000.PDS	417/ 9417	AIRS	Special Case: L1A Product Input	[6.9]	Special Case: AIRS Flex HR ENG #2 Packets APID 417/9417; substituted for APID 415 when instrument is commanded to produce flexible engineering data
AVI3_ANH	gblav.1998-09-12.T18Z.PGrbF03.anc	2203, 2213, 2223, 2233 & 2243	L2 Dynamic Ancillary Input	328.0	Aviation forecast from model; 2203, 2213, 2223, 2233 & 2243: 3-hour aviation forecast for 18Z-hour, 00Z-hour, 06Z- hour, 12Z-hour, 18Z-hour, respectively, cycle time on day prior to day in which granule starts	

AVI6_ANH	gblav.1998-09-12.T18Z.PGrbF06.anc	2206, 2216, 2226, 2236 & 2246	L2 Dynamic Ancillary Input	328.0	Aviation forecast from model; 2206, 2216, 2226, 2236 & 2246: 6-hour aviation forecast for same model as 2203, 2213, 2223, 2233 & 2243, respectively
AVI9_ANH	gblav.1998-09-12.T18Z.PGrbF09.anc	2209, 2219, 2229, 2239 & 2249	L2 Dynamic Ancillary Input	328.0	Aviation forecast from model; 2209, 2219, 2229, 2239 & 2249: 9-hour aviation forecast for same model as 2203, 2213, 2223, 2233 & 2243, respectively
PREPQCH	L2.gdas1.980913.T00Z.BufPREPda.anc	6400	RaObs  RaObs PGE Dynamic Ancillary Input	12.0	NOAA Radiosonde Observations



### Appendix C-3. AIRS Static Ancillary Inputs

ESDT Short Name	Sample File Name (Local Granule ID)	PCF LID	Instr.	Usage	File Size (MB)	Description
AIRXADCM	L1A.decom_map_hsb.v1.1.0.anc	4001		L1A Ancillary Input	0.04	Decom Map
AIRIARAN	L1A.eng_sumry_fds.v1.0.0.anc	4011	AIRS	L1A Ancillary Input	0.03	Limits for selected AIRS engineering parameters
AIRXACRV	L1A.tlm_calcurve_amsu.v1.1.1.anc	4009		L1A Ancillary Input	0.05	Calibration conversion data numbers ranges
AIRXAPLY	L1A.tlm_polyconv_amsu.v1.1.0.anc	4010		L1A Ancillary Input	0.01	Polynomial conversion constants
AIRXARYL	L1A.tlm_rylim_airs.v2.0.0.anc	4005		L1A Ancillary Input	0.60	Red & Yellow Limits
AIRXAGEO	L1A.geolocation.v2.4.0.anc	4006		L1A Ancillary Input	0.01	Geolocation Parameters
AIRHBPAR	L1B.HSB_AncMain.v2.0.0.anc	3601	HSB	L1B Ancillary Input	0.01	HSB calibration parameters
AIRHBSLC	L1B.HSB_SLCorr.v1.0.0.anc	3602	HSB	L1B Ancillary Input	0.03	HSB sidelobe correction matrices
AIRHBSLI	L1B.HSB_SLInterp.v2.0.0.anc	3604	HSB	L1B Ancillary Input	0.01	HSB cold sidelobe interpolation arrays

AIRABPAR	L1B.AMSU_AncMain.v2.0.0.anc	3501	AMSU-A	L1B Ancillary Input	0.01	AMSU-A calibration parameters
AIRABSLC	L1B.AMSU_SLCorr.v1.0.0.anc	3502	AMSU-A	L1B Ancillary Input	0.04	AMSU-A sidelobe correction matrices
AIRABSLI	L1B.AMSU_SLInterp.v2.0.0.anc	3504	AMSU-A	L1B Ancillary Input	0.04	AMSU-A cold sidelobe interpolation arrays
AIRXBPAR	L1B.config_file1.v1.2.0.anc	3005	AIRS	L1B Ancillary Input	0.06	L1B Calibration parameters
AIRIBFRQ	L1B.airs_freq.v1.0.0.anc	3006	AIRS	L1B Ancillary Input	0.02	AIRS frequency list
AIRIBFPM	L1B.airs_focal_plane_map.v1.1.0.anc	3007	AIRS	L1B Ancillary Input	0.001	AIRS focal plane map
AIRIBSFF	L1B.spectral_feature.v1.2.0.anc	3010	AIRS	L1B Ancillary Input	0.17	AIRS spectral features
AIRIBNLC	L1B.non_linear_corr.v1.1.0.anc	3011	AIRS	L1B Ancillary Input	0.09	AIRS Non-linearity correction coefficients
AIRIBPOL	L1B.polarization_corr.v1.1.0.anc	3012	AIRS	L1B Ancillary Input	0.04	AIRS polarization correction coefficients
AIRIBSVS	L1B.space_view_sel.v1.0.0.anc	3013	AIRS	L1B Ancillary Input	0.0007	AIRS space view selection parameters
AIRIBPOP	L1B.popcorn_corr.v1.0.0.anc	3014	AIRS	L1B Ancillary Input	0.01	AIRS popcorn correction parameters

AIRIBQPR	L1B.airs_qa.v1.3.0.anc	3015	AIRS	L1B Ancillary Input	0.3	AIRS QA parameters
AIRVBCPR	L1B.vis_param.v1.0.0.anc	3009	AIRS	L1B Ancillary Input	0.003	VIS calibration parameters
AIRVBQPR	L1B.vis_qa.v1.1.0.anc	3016	AIRS	L1B Ancillary Input	0.01	VIS QA parameters
AIRI2TMC	L2b.trcoef.airs.v5.1.0.anc	2001	AIRS	L2 Ancillary Input	36.9	AIRS IR Channel Transmittances
AIRA2TMC	L2.trcoef.amsu.v3.0.0.anc	2002	AMSU-A	L2 Ancillary Input	0.13	AMSU-A Transmittances
AIRH2TMC	L2.trcoef.hsb.v3.0.0.anc	2003	HSB	L2 Ancillary Input	0.05	HSB Transmittances
AIRX2CLI	L2.uars_clim.v1.0.1.anc	2005		L2 Ancillary Input	1.2	Climatology to set initial guess profiles
AIRX2AAC	L2h.angle_adj_coef.v2.1.4.anc	2006		L2 Ancillary Input	40.9	Angle Correction Coefficients
AIRX2AEI	L2.F.error_est.v1.0.0.anc	2007		L2 Ancillary Input	0.01	Ancillary error estimate inputs
AIRX2ABT	L2h.brtemp_tuning_coef.v2.0.0.anc	2008		L2 Ancillary Input	29.4	BRTemp Tuning Coefficients
AIRI2SRD	L2.airs_solar_rad.v5.1.0.anc	2009	AIRS	L2 Ancillary Input	0.06	Solar radiances

AIRX2CAV	L2.cloud_avg.v2.0.0.anc	2010		L2 Ancillary Input	0.24	Parameters determining channel averaging vs. extrapolation
AIRM2MEC	L2.M.ecof_705.v1.0.0.anc	2011		L2 Ancillary Input	0.004	MW emissivity coefficients
AIRM2MCM	L2.M.cov100av.v1.0.0.anc	2012		L2 Ancillary Input	0.22	MW temperature profile covariance matrix
AIRH2AAW	L2.M.weight.hsb.v1.0.0.anc	2013	HSB	L2 Ancillary Input	0.003	HSB ASCII Weight
AIRI2CHP	L2.l.channel_prop.v5.1.2.anc	2014	AIRS	L1B AIRS & L2 Ancillary Input	0.21	AIRS Channel properties
AIRI2OLR	L2h.F.coef_olr.v1.0.0.anc	2015		L2 Ancillary Input	0.06	Outgoing longwave radiation coefficients
AIRX2ICW	L2.l.peak_wgt.v2.0.0.anc	2021		L2 Ancillary Input	0.17	FIRST cloud clearing weighting function sensitivities
AIRX2MAS	L2.masuda.v1.0.0.anc	2016		L2 Ancillary Input	0.06	Coefficients for Masuda model of ocean emissivities
AIRX2CTC	L2.l.cleartest_coef.v2.0.2.day.anc	2054 & 2055		L2 Ancillary Input	0.004	Coefficients to predict AIRS radiance from AMSU-A
AIRI2FRQ	L2.l.clr.regcoef.v1.0.1.anc	2056 & 2057		L2 Ancillary Input	1.1	Clear sky detection regression coefficients
AIRI2FEV	L2.l.eigvec_allang.solang.nf.v2.0.0.anc	2041 & 2042	AIRS	L2 Ancillary Input	6.6	FIRST retrieval first guess matrix of eigenvectors for nighttime footprints

AIRI2FRD	L2.l.rcoef.solang.v2.0.0.anc	2043 & 2044	AIRS	L2 Ancillary Input	0.6	FIRST first guess principal component mode regression coeff daytime footprints
AIRI2IFC	L2.l.freq.eigvec.v2.0.0.anc	2045	AIRS	L2 Ancillary Input	0.02	FIRST retrieval first guess eigenvectors AIRS channels list
AIRX2ANG	L2.l.ang_pc.v2.0.0.anc	2046		L2 Ancillary Input	7.9	Principle components for angle adjustment
AIRX2ICM	L2.l.airs_covmtx.v2.0.0.anc	2051		L2 Ancillary Input	0.6	FIRST physical retrieval covariance matrix for L2 parameters
AIRX2ITC	L2.l.freq.tmp.ret.v2.0.0.anc	2052	AIRS & AMSU-A	L2 Ancillary Input	0.001	FIRST retrieval temperature channel list for AIRS and AMSU-A
AIRX2IWC	L2.l.freq.h2o.ret.v2.0.0.anc	2053	AIRS & HSB	L2 Ancillary Input	0.001	FIRST retrieval water channel list for AIRS and HSB
AIRX2NLD	L2_DEFAULTS100.v2.0.4.anc	2061		L2 Ancillary Input	0.01	Namelist giving default values for L2 parameters
AIRV2PRM	L2.vis_nir.v2.0.0.anc	2065	AIRS	L2 Ancillary Input	0.001	V/NIR parameters
AIRHBMLC	BR.L1B.HSB_limb.v1.0.0.anc	3703	HSB	HSB Daily Browse PGE Ancillary Input	0.01	HSB L1B browse limb correction
AIRHBCTB	BR.L1B.HSB_hdf_color_tbl.v1.0.0.anc	3705	HSB	HSB Daily Browse PGE Ancillary Input	0.001	HSB L1B browse color table
AIRABMLN	BR.L1B.AMSU_limb_nosea.v1.0.0.anc	3701	AMSU-A	AMSU Daily Browse PGE Ancillary Input	0.03	AMSU L1B browse limb correction - no sea

AIRABMLS	BR.L1B.AMSU_limb_sea.v1.0.0.anc	3702	AMSU-A	AMSU Daily Browse PGE Ancillary Input	0.029	AMSU L1B browse limb correction - sea
AIRABCTB	BR.L1B.AMSU_hdf_color_tbl.v1.0.0.anc	3704	AMSU-A	AMSU Daily Browse PGE Ancillary Input	0.001	AMSU L1B browse color table
AIRIBCTB	BR.L1B.AIRS_hdf_color_tbl.v1.0.0.anc	3705	AIRS	AIRS Daily Browse PGE Ancillary Input	0.001	AIRS L1B browse color table
AIRX2BCTB	BR.L2.RET_hdf_color_tbl.v1.0.0.anc	2082	AIRS	AIRS L2 Retrieved Product Daily Browse PGE Ancillary Input	0.001	AIRS L2 Retrieved Product browse color table
AIRI2BCTB	BR.L2.CC_hdf_color_tbl.v1.0.0.anc	2081	AIRS	AIRS L2 Retrieved Product Daily Browse PGE Ancillary Input	0.001	AIRS L2 Cloud-Cleared Radiance browse color table
AIRVBVIM	AVHRR_NDVI_Apr11to20_1993.v1.0.0.anc	2301 - 2312	AIRS	L2 Ancillary Input	700	Static monthly mean multiday surface visible maps, for use when no dynamic AIRVBVIM available